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Journal of the Society of Arts.

FRIDAY, FEBRUARY 7, 1862.

INTERNATIONAL EXHIBITION OF 1862.

The Council beg to announce that the Guarantee Deed is now lying at the Society's House for signature, and they will be much obliged if those gentlemen who have given in their names as Guarantors, as well as others interested in the Exhibition, will make it convenient to call there and attach their signatures to the Document. Signatures for sums amounting in the aggregate to £445,000, have been attached to the Deed.

Guarantors holding ivory tickets for visiting the building are informed that those tickets are no longer available.

WEEKLY PROGRESS OF THE INTERNATIONAL EXHIBITION.

Now that the decoration of the building is finally decided, Mr. Crace has commenced the work entrusted to him very energetically. Already the fifty feet courts are showing signs of his exertions. The columns of these courts are coloured a green bronze, with dark red capitals and bases, and a similar dark line runs along the long girders. In the nave great effect will be produced by the scarlet and gold capitals and the gilt ornament of the roof. Each girder will bear at the top the name of some one of the exhibiting countries or their colonies.

The colouring of the machinery annexe has been undertaken by Captain Fowke. The girders will be a warm lavender, while the roof is a yellow stone colour. The effect of this treatment is to give great length to the building.

The northern courts are now entirely roofed in, and wait only for the flooring to be ready for the reception of goods. The plasterers are busy at work upon the upper story of the refreshment arcades, and the cellarage in the eastern portion is in course of construction. The picture galleries are so far advanced that the interior scaffolding has been entirely removed, and a clear view is obtained from one end of the building to the other. The attic story over the central entrance is also completed; the front of this hall will be decorated by Benson's clock, for which space has been left.

Her Majesty's Commissioners are now engaged in directing allotments of space to be forwarded to exhibitors A plan of each allotment is drawn to scale, showing the passages and allocation of the neighbouring exhibitors, thus at once enabling each one to appreciate and make the most of the advantages of his situation. These allotments have already been sent out for surgical instruments, class 17, and will be followed very shortly by those for textile fabrics, philosophical instruments, class 13, stationery and printing, class 28, and horology, class 15. In each case, they are first submitted to the Metropolitan Trade Committees for their approval. Sheffield, Birmingham, Wolverhampton, &c., will have distinct courts, in which they can arrange their goods in their own way.

Intelligence has been received of many valuable cargoes from distant settlements now on their way—some of it favourable, some unfavourable. The *Huguenot*, from Ceylon, containing seventeen cases for the Exhibition, has just gone on shore near Boulogne.

Mr. Campbell, the Local Commissioner for Japan, has delivered a general catalogue, which promises an excellent show on the part of that little-known country. The works of industry and art in which the Japanese most excel are of great variety. Many of them will not only bear comparison with the best workmanship of Europe, but in many points they cannot be rivalled. Manchester and Birmingham, London and Paris, will each find in a Japanese collection articles that either cannot be produced in their workshops, or only at a cost that would make them practically unsaleable. Many of these articles, however, with all their delicacy of workmanship and perfection of material, such as the finer kinds of eggshell, porcelain, and china; the inlaid, enamelled, and chiselled metal work; the crape silk fabrics, and the lacquered ware, are procurable in Japan, especially by the native purchasers, at very moderate prices. Others again are very costly, and can only be obtained at prices which in Europe would probably be thought far beyond their value. These are chiefly specimens of old lacquer, old bronzes—the finer kinds of ivory carving, swords, and armour, of which latter class the armed retainers of the Daimios, and the feudal chiefs themselves are extravagant admirers and collectors. When wealthy they will give any price for an approved weapon by a maker of great repute.

As the object of this Japanese collection is to exhibit, as far as limits of space and means will allow, a fair sample of the Japanese, and their capabilities of production in rivalry with the nations of the West, all the articles selected will be found to throw some light on this question of competitive power of production, as well as on the progress in civilisation of a people who have been nearly wholly unaided by contact with the European race.

The various objects are thus classified :—

Specimens of Lacquer-ware.—Lacquering on wood; lacquer and inlaid woods mixed; lacquer on other materials, shells, ivory, tortoise-shell, &c.

Specimens of Straw-Basket Work, and lacquer, and

lacquer combined in articles of use and ornament; basket and rattan work.

Specimens of China and Porcelain of every variety, enamelled, lacquered, and plain; also of pottery, and quaint forms of earthenware.

Specimens of Metallurgy and Mineral Products.—Bronzes, simple and inlaid with other metals; medallions and intaglios in pure and mixed metals; brooches, medals, buttons, &c.; cutlery and workmen's tools; arms and armour.

Manufactures of Paper.—Raw materials; paper for rooms, for writing, for handkerchiefs, for waterproof coats, &c.; imitation leather.

Textile Fabrics.—Silk crapes, silks, tapestry; printed cottons; fabrics from the bark of a creeper.

Works of Art.—Carvings in ivory, wood, paintings, illustrated works, lithochrome prints, &c.

Educational Works and Appliances. — Books of science, scientific models and instruments (chiefly copied from the Dutch), Japanese shells, toys, &c.

There will also be a miscellaneous collection of specimens of lacquer-ware, lacquering on wood, inlaid wood and laquer mixed.

Lacquer on the Materials, as ivory, shells and tortoise-shell, &c.; and inlaid woods.

The articles will number more than 600, the bulk of which have been gathered together by Mr. R. Alcock, C.B., her Majesty's Minister at the Court of the Tyckoon.

ROAD CONNECTING THE DISTRICTS NORTH AND SOUTH OF HYDE-PARK AND KENSINGTON-GARDENS.

The Council of the Society of Arts, in consequence of the interest which the Society has in the permanent building for International Exhibitions at South Kensington, recently appointed a Committee to consider the best means of obtaining some road for connecting the districts north and south of Hyde-park, having particularly in view the opening of such road during the Exhibition of 1862. The Committee has reported that:—

"The First Commissioner of Public Works, on the part of the Crown, after considering the various projects that have been made to him for connecting the districts north and south of Hyde-park and Kensington-gardens, has authorised the making of a road which will take the following course:—On the north side the road will begin in the Bayswater-road, slightly to the west of Victoria-gate; it will proceed along the ha-ha or ditch which separates Kensington-gardens from Hyde-park; it will then cross the Serpentine-bridge on a level, and pass through one tunnel, so as not to interfere with Rotten-row, and through a second tunnel whereby the carriage road parallel with the Kensington-road is left untouched. Excepting, therefore, on the Serpentine-bridge, the road throughout will be sunken, and cause no interference whatever with the present public enjoyment of Kensington Gardens and Hyde Park. Should the Metropolitan Board of Works assent to making this road, there would be no occasion to apply to Parliament for any powers; but if, on the contrary, the Metropolitan Board should decline, then it will be necessary to obtain Parliamentary sanction to levy tolls and raise debentures on the security of them.

"It is proposed that such debentures shall bear 5 per cent. interest, and shall give to each proprietor a transferable free pass for each debenture, not exceeding five. The tolls are to be redeemable when the capital has been paid off, and the repair of the road will be charged on the tolls.

"In the first instance the capital to be raised will be £35,000; but, to provide for any alterations on the Serpentine-bridge, should it be necessary, powers will be sought slightly to increase it.

"It is proposed that trustees shall be created for the administration of the funds; that such trustees shall consist of representatives of the Exhibition of 1851 and of the Exhibition of 1862, the chairman of the Council of the Society of Arts for the time being, and some other representatives of local interests."

If the Metropolitan Board of Works decline to make the road there, then the only alternative of having a road will be to make it upon the voluntary principle. Donations in aid will be received, but it is chiefly by means of a toll to be paid by those who find it convenient to use the road that the cost and maintenance of it can be defrayed.

Among the parties who have expressed a desire to take debentures are the Earl Granville, K.G., Commissioner for the Exhibitions of 1851 and 1862; the Earl of Shelburne, Sir Wentworth Dilke, Bart., Commissioner for the Exhibitions of 1851 and 1862; Thomas Baring, Esq., M.P., Commissioner for the Exhibitions of 1851 and 1862; Thomas Fairbairn, Esq., Commissioner for the Exhibition of 1862; the Directors of the Great Western Railway; J. G. Frith, Esq., &c.

Plans and surveys of the roads and levels have been made by Mr. J. Fowler, C.E., by the direction of the first Commissioner of Public Works, who will forthwith apply to Parliament for the necessary powers to levy tolls.

Persons desirous of obtaining debentures issued by sanction of Parliament, or making donations in aid of the road, are requested to apply to P. Le Neve Foster, Esq., Secretary of the Society of Arts, John-street, Adelphi.

FORM OF APPLICATION.

To P. Le Neve Foster, Esq., Society of Arts.

Please to register my application for ________________

Debentures of £100 each, to be issued ________________

according to Act of Parliament, on the Security of the Tolls to be taken for making a Road to connect the Districts North and South of Hyde-park; and I agree to accept the same, or any less number which may be allotted to me.

____________________ Name.

____________________ Address.

________________ day of ________________

or

Please to enter my name as a Donor of ________________

towards making the road, &c.

____________________ Name.

____________________ Address.

EIGHTH ORDINARY MEETING.

WEDNESDAY, FEB. 5TH, 1862.

The Eighth Ordinary Meeting of the One Hundred and Eighth Session was held on Wednesday, the 5th inst., Dr. A. W. Miller, F.R.S., Professor of Chemistry, King's College, London, in the chair.

The following candidates were proposed for election as members of the Society:—

Bally, Otto	(Messrs. Arles Dufour & Co.), 41, Threadneedle-st., E.C.
Cameron, Capt. W. Ogilvie.	Langbourne-chambers, 16½, Fenchurch-street, E.C.
Cave, Rev. Thos. Wells...	53A, City-rd., Finsbury, E.C.
Dowson, Joseph E.	38, Dowgate-hill, Cannon-street, E.C.
Groombridge, Henry	5, Paternoster-row, E.C.
Groombridge, Richard ...	5, Paternoster-row, E.C.
Hodgkinson, S.	43, Threadneedle-street, E.C.
Hooper, B.	43, King William-st., E.C.
Judson, Henry	10, Scott's-yard, Bush-la., E.C.
Killy, C. O.	52, Bread-st., Cheapside, E.C.
Lambert, Henry T.	74, Grosvenor-street, W.
Mavor, William	77A, Park-st., Grosvenor-sq. W.
Meeson, Richard	Duvals, Gray's, Essex, and 8, George-yard, Lombard-st., E.C.
Mourant, Edward	Samarès Manor, Jersey.
Noble, George	4, George-yard, Lombard-st., E.C.
Noble, Joseph Alfred ...	4, George-yard, Lombard-st., E.C.
Poulton, J. Fox	153, Cheapside, E.C.
Worth, Charles Jones ...	City Band, Treadneedle-st., street, E.C.

The following candidates were balloted for and duly elected members of the Society:—

Bentley, Robert J.	Finningley-park, Bawtry.
Brinton, John	Kidderminster.
Champion, Percival	Stamford-hill, N.
Countze, George	103, Long-acre, W.C.
Crisp, W. B.	81, St. John-street-road, E.C.
Evans, Anthony	34, Bloomsbury-square, W.C.
Hooper, J. K.	20 and 21, Queenhithe, E.C.
Lahee, Samuel	17, Brompton-square, S.W.
Lendy, Captain A.	Practical Military College, Sunbury, S.W.
Massey, Thomas	5, Gray's-inn-square, W.C.
Sim, William	1, Dane's-inn, Strand, W.C.
Spencer, Thomas	Newburn Steel Works, 5, Westgate-street, Newcastle-on-Tyne.
Wurtzburg, Edward	May-villa, Leeds.

The Secretary called attention to some electrotype copies of Pistrucci's great Waterloo Medal, placed on the table for the inspection of the members by Mr. W. Johnson.

It has been determined to multiply copies of this medal by means of the electrotype, and for this purpose the Lords Commissioners of Her Majesty's Treasury have authorised the Master of the Mint to place the matrixes in the hands of Mr. Johnson, who will at once proceed to execute such numbers as may be subscribed for by the public.

The Paper read was—

ON IMPROVEMENTS AND PROGRESS IN DYEING AND CALICO PRINTING SINCE 1851.

BY DR. F. CRACE CALVERT, F.R.S.

I cannot presume to give, in a paper like the present, an account of all the improvements and inventions which must have occurred in such extensive trades as those of dyeing and calico printing during a space of ten years, and especially during a decade of extraordinary progress like that which has just passed. The utmost, therefore, that I can do is, to lay before you an outline of the principal discoveries which have come to *my knowledge* during the period under consideration.

I wish, however, to state that the processes of which I shall speak to-night are those generally known to calico-printers; for it will be easily understood that many printers may use methods peculiarly their own, and that it would be a breach of confidence were I to publish any such processes that may have been communicated to me.

I shall divide the subject into two heads. First, treating of new dyeing materials obtained from well-known dyestuffs, and then of dyestuffs altogether new, together with their application to dyeing. Secondly, I shall consider the subject of calico printing.

Madder.—This valuable dyestuff, which is chiefly imported from France, Turkey, Italy, and Holland, is obtained from the *Rubia Tinctorum*. Our chemical knowledge of the composition of this root, so important to dyers and calico printers, was, up to 1851, in a most unsatisfactory state. Thus, whilst we find that MM. Decaisne, Jean Gerber, Edmund Dollfus, &c., asserted only one colouring principle, to which they gave the names of *alizarine*, *colorine*, or *azale*, others, such as M.M. Persoz, Runge, &c., admitted two colouring principles, *alizarine* and *purpurine*, and Kuhlmann added to these two, a third, called *xanthine*. But Dr. Edward Schunck, F.R.S., published, in 1851, his most valuable and extensive researches on the chemical composition of madder, which not only threw much light on the colour-giving principle of the rubia root, but also, as I will presently show, led to valuable commercial applications. He ascertained that, although the roots contained a certain quantity of colouring matter called alizarine, yet that the ultimate source of this only colour-giving principle was a substance to which he gave the name of *rubian*. He further found that one equivalent of this substance under the influence of a ferment called *erythrozym*, or of acids, or alkalies, would, by losing 14 equivalents of water, be converted into 4 equivalents of alizarine, as the following equation shows:—

$$\underset{\text{Rubian.}}{C_{56}H_{34}O_{30}} = 4\,(\underset{\text{Alizarine.}}{C_{14}H_{3}O_{4}}) + \underset{\text{Water.}}{14\,HO}$$

This result satisfactorily explained the change of madder into garancine by the action of sulphuric acid on that root, from the fact that rubian was susceptible of conversion, under the same influences, not only into alizarine, but also into two valueless substances, called rubiretine and verantine. This led Dr. Schunck, in conjunction with Mr. Simon Pincoff, in 1852, to the production of a most important dyeing material, called by them *commercial alizarine*. But to enable you to understand in what this product differs from garancine, and also its mode of preparation, it is necessary that I should state that the verantine and rubiretine are not colour-giving principles, and that they interfere with the beauty and brightness of the fine shades of purple given by alizarine, which, according to Dr. Schunck, is the only colour-giving principle contained in madder.*

Garancine, which, even before 1851, was extensively used for producing red, purple, and chocolate upon calico, was obtained, as you are aware, either by mixing together at an ordinary temperature equal weights of madder and sulphuric acid, then adding water, when the garancine was

* Dr. Schunck also obtained as products of decomposition of rubian, rubianine and sugar. Those who are interested in these chemical researches will find them fully detailed in the Transactions of the Royal Society.

produced, requiring only to be thoroughly washed so as to remove the acid;—or by mixing the roots with one-third their weight of sulphuric acid previously diluted with water, and carrying the whole to the boil for one or two hours, washing the residue repeatedly, and using, in the last operation, some alkaline carbonate. Although garancine thus prepared gave colours similar to madder, yet they were wanting in solidity. This effect, especially as regards purples, was overcome by Messrs. Pincoff and Schunck by taking principally garancine prepared as above, but thoroughly depriving it of acid, and submitting it to the action of high pressure steam, when the substance called verantine is decomposed or modified so as not to interfere with the purple dyeing power of alizarine. The advantages possessed by this product, which is now so extensively employed in calico printing, that several millions of pieces have been dyed with it, are, as stated by Messrs. Pincoff and Schunck, as follows:—It produces good lilacs economically and without soaping; great promptitude and regularity in the production; facility of producing combination of lilacs with catechu, lilac and chocolate, and lilac and orange, which results cannot be obtained so satisfactorily with madder or garancine; production of lilac shades graduated *ad libitum*. Lastly, economy of mordaunts. I shall again refer to this in speaking of calico printing.

Whilst on this class of madder products, I may refer to an improvement effected by Mr. John Lightfoot, in the manufacture of garanceux, (which was discovered in 1843 by Mr. Schwartz), or spent madder, which has been treated with sulphuric acid, as above described, for the preparation of garancine. The method now generally followed is to collect the spent madder in bags as it runs from the dyebecks, and then throwing it on to a heap, to be ultimately converted into garanceux, by acting upon it as above described, with sulphuric acid. Mr. Lightfoot, however, recommends large vats to be provided, allowing to run into them the hot spent madder liquors of the dyebecks, together with vitriol, leaving the whole to stand for 24 hours, running off the clear liquor and washing the solid garanceux thus produced, until all impurities and acid are removed. The advantages claimed are, first, saving of fuel, by economising the heat of the waste liquors, and secondly, the production of one-fourth more colouring matter. Of late years the French calico printers have applied, for light styles of madder-pinks, extracts of madder, or garancine, which have generally been obtained by treating madders or garancines with alcohol or wood-spirit, and adding to them acetate of alumina and acetic acid; a similar process has recently been patented by Mr. F. A. Gutty. Another most interesting process has recently been published by Mr. Emile Kopp, for the production of alizarine from garancine. It consists in submitting dry garancine in a double cylinder to the action of superheated and saturated steam, when the alizarine is carried off by the steam, and the whole condensed in a refrigerator.

Flower of Madder.—This product, which is now extensively used by continental printers, and which was introduced to the trade by MM. Julian and Roquer towards the beginning of 1852, is prepared by allowing madder to ferment, and then washing it thoroughly, which removes from it, not only all soluble matters such as sugar, mucilaginous substances, acids, &c., which interfere with the fixation of the alizarine on the various mordaunts, but also (in accordance with Dr. Schunck's researches on the influence of the ferment erythrozym on rubian), increases the quantity of colour-giving principle or alizarine. It is found, by experience, that 100 parts of flower of madder are equal to about 200 parts of ordinary ground roots, and that the shades are finer, the pinks and reds also having greater solidity. Mr. E. Mucklow has recently patented a process similar to the above, which consists in alternately macerating and pressing madder roots so as to expel from them various materials which, as above stated, interfere with the dyeing of the fabrics.

Mr. Emile Kopp has published a very interesting paper on the subject of madder, in which he proves that, if the madders of Alsace are treated with a weak solution of sulphurous acid, and to this solution, which has a fine golden colour, he adds three or four per cent. of hydrochloric acid, and heats the whole to a temperature of 150°, a red colouring matter is precipitated, which he states to be pure *purpurine*. If, after the separation of this precipitate, the liquor is again carried to the boil, a new colouring matter is formed, which he calls *green alizarine*, and finds to be composed of pure alizarine and a dark green resin, which he considers is produced by the decomposition of chlorogenine.

As a *resumé* of my observations on madder, I may state that the only two madder products which have received extensive application since 1851 are commercial alizarine and flower of madder.

Indigo.—I have the pleasure again to draw your attention to a series of researches by Dr. Edward Schunck, and to enable you to appreciate the value of his discoveries in connexion with this important dyestuff, it is necessary that I should first state that chemists held two different opinions as to the condition in which the colouring matter existed in the indigo plants. Thus, Chevreul, Girardin, &c., considered that the indigo contained in the plant was in the form of white, or de-oxygenated blue indigo; whilst Giobert and others believed that it did not pre-exist in the vegetable, but was formed during the process of fermentation, which is usually employed for the extraction of the colour from the *Isatis tinctoria* and *Indigofera anil*. Serious doubts having arisen in the mind of Dr. Schunck, whether either of these theories correctly explained the state in which indigo existed in the indigo plant, he undertook a long series of researches, by which he was enabled to show, with a positive certainty, that the *Isatis tinctoria* contains a substance easily soluble in hot and cold water, alcohol, and ether, and which, by the action of strong mineral acid, yields indigo blue. Further that the formation of the colouring matter from it can be effected without the intervention of oxygen or of alkalies, and that the latter, indeed, if allowed to act upon it before the application of acid, entirely prevents the formation of the colouring matter; viz., indigo blue. To ascertain whether the substance which he calls *indican*, pre-existed in the plant, Dr. Schunck operated as follows:—He digested in ether some perfectly dry leaves of the *Isatis tinctoria*, removed the ethereal solution, and having exposed it to spontaneous evaporation, it left a green syrupy residue, from which water extracted *indican*, for by the action of boiling sulphuric acid, it yielded an abundance of indigo blue. To obtain the *indican* in a high state of purity, he found it necessary to treat the leaves with alcohol and ether, and to submit the extract to various chemical operations, to get rid of all impurities, so as to obtain indican as a yellow transparent glutinous substance, of a slightly bitter and nauseous taste. This substance presents the remarkable property (similar to that of rubian in madder) of being susceptible under the influence of a ferment in the plant, or of acids, of yielding indigo blue and sugar, as seen by the following chemical formula:—

$$\begin{array}{ll} \text{1 eq Indican} & C_{52}\,H_{31}\,NO_{34} \\ \text{4 eqs Water} & \quad\;\; H_{4}\quad O_{4} \\ \hline & C_{52}\,H_{35}\,NO_{38} \end{array} \Big\} = \Big\{ \begin{array}{ll} C_{16}\,H_{5}\,NO_{2} & \text{1 eq Indigo blue} \\ C_{36}\,H_{30}\quad O_{36} & \text{3 eqs Sugar} \\ \hline C_{52}\,H_{35}\,NO_{38} & \end{array}$$

To obtain this interesting decomposition with acids, it is simply necessary to heat the indican with strong sulphuric or hydrochloric acid, when the Indigo blue precipitates while the sugar remains in solution. But indican is so liable to undergo modifications, that if the action of the acids be continued, besides the indigo blue an indigo purple is formed, called by Dr. Schunck *indirubine*. To fully appreciate the value of these researches it is necessary that I should lay before you an outline of the manufacture of indigo, as some of you may not be acquainted with it. Commercial indigo is obtained from plants belonging to the leguminous tribe, known under the general name of *indigofera*, that

these plants are mowed and placed in large vats with water, and allowed to ferment for 8 or 10 hours, when the supernatant liquor first becomes green and then blue. It is then run off into other vats and well agitated, so as to bring it thoroughly under the action of the atmospheric oxygen, when the white soluble indigo becomes thoroughly oxydised into blue insoluble indigo. A little lime water is now added and the whole left to settle, the deposit collected on a cloth, drained, pressed, divided into square lumps, and dried in the sun, when it constitutes commercial indigo. Dr. Schunck's researches show, as above stated, that under the influence of a ferment the *indican* is converted into sugar and white indigo; and they also explain that if the manufacturer is not extremely careful he may experience great loss in the amount of indigo obtained, for Dr. Schunck has observed that *indican*, when dissolved in water, is liable to undergo rapid modifications, and that instead of yielding by the acids indigo blue and *indirubine*, it gives *indiretine, indihumine*, &c. You will, doubtless, be struck, with the great similarity which exists between the colour-giving principles of the madder and indigo plants, and with the light thrown upon this class of tinctorial matters by the laborious researches of Dr. Schunck. I cannot leave this interesting substance without stating that, although one or two attempts have been made to introduce new preparations of indigo, they have not, to my knowledge, yet received the sanction of the trade. Such are the preparations of the sulpho-indigotic acid of Mr. Haeffly, the sulpho-purpurate of soda of Mr. Bolley, and the indigo of Mr. Johnson.

Orchil.—It is hardly necessary for me to state that this dyestuff has been used for producing violets, mauves, reds, and other colours for many years, and that the colouring matter was obtained by allowing lichens to remain in contact at natural temperature for several weeks with putrid urine and a little lime, and that of late years ammonia has been substituted for urine, with the addition of a little carbonate of soda, nitrate of soda, or alum. You are also doubtless aware that Robiquet was the first to obtain a colourless principle called *orcine*, and to show that under the influence of oxygen and ammonia it became transformed into water and a red colour called *orcéine*, and that Dr. Schunck proved that a substance extracted by him under the name of *lecanoric acid*, from lichens, would, under the influence of heat and a solution of baryta, decompose itself into water, carbonic acid, and orcine. Without overlooking the interesting researches of Heeren and Sir Robert Kane on this subject, I must especially mention the labours and valuable researches of Dr. Stenhouse, which not only added greatly to our knowledge of the various chemical principles existing in lichens from which the orchil colouring matters are obtained, but also led him to discover a commercial method of extracting from the lichens the various organic substances capable of giving orchil colours when placed in favourable conditions. He also showed that the very small per-centage of colouring matters in proportion to the bulk of weed might be cheaply and commercially extracted in the locality where the lichens grow, thus saving the enormous expense of carrying a large bulk of useless matter from Africa and elsewhere to this country. If this valuable hint of Dr. Stenhouse's has not yet been acted upon as regards the saving of transport, his process for extracting the colour-giving principle has of late years been extensively adopted by manufacturers of orchil, enabling them to obtain cheaper and better colours from lichens. But still none of these advantages led manufacturers to the great desideratum of giving fastness to the beautiful purple shades obtained from orchils until 1856, when Mr. Marnas, of the firm of Guinon, Marnas, and Bonnet, of Lyons, found that by treating lichens, as suggested by Dr. Stenhouse, with milk of lime, filtering the lime liquor off and precipitating the colour-giving principle from it with hydrochloric acid, gathering these on a filter, and after having properly washed them, dissolving them in caustic ammonia, and keeping this ammoniacal liquor at a temperature of 153° to 160° for 20 to 25 days, when under the influence of that temperature, the colour-giving principles of the lichens fix ammonia and oxygen and are transformed into a new series of products, which Mr. Marnas separates from the coloured liquor by adding chloride of calcium, which causes a fine purple lake to be deposited, which, after being well washed and dried, is sold under the name of *French purple.* It is easy to understand that the chloride of calcium can be replaced by salts of alumina, tin, &c. What characterises this orchil colour from those previously known is, that it dyes animal fibres with greater facility than the common orchil, that it gives directly mauve colours, which can be modified by adding to them a little carmine of indigo, roseine, &c.; but the essential difference of these purples and mauves from ordinary orchil colours is—that while the latter are destroyed by acids and light, those of Mr. Marnas, on the contrary, withstand their action, thus accounting for the public favour given to Messrs. Guinon, Marnas, and Co.'s orchil colours. To dye silk or wool with French purple it is simply necessary to mix the lake with its weight of oxalic acid, boil with water and then filter, the oxalate of lime remaining on the filter while the colour passes in the filtrate. This liquor is then added to a slightly ammoniacal liquid contained in the dye-beck; all that is now necessary is to dip in the beck, silk, wool, cotton, mordaunted with albumen, or cotton prepared for Turkey red, when any of these materials will become dyed with magnificent fast shades of purple or mauve. It is a curious coincidence that after many years of anxious search, two purples from widely different sources should have been first discovered in the same year (1856) in different countries. I allude to Mr. Perkin's purple from coal tar, to which I shall refer further on.

Catechu, or *Terra Japonica*, which is extracted from the wood of the acacia catechu, and which we import in large quantities from the East Indies, is daily becoming of increased importance, owing to the great variety of colours that can be obtained with it. It contains two very distinct substances, a tannin (studied by Dr. Stenhouse) which gives a green precipitate with salts of per-oxide of iron, and also a substance called *catechine*, which under the influence of alkalies and oxygen is rapidly transformed into two acids called japonic and rubinic acid. As in catechu, the tannin gives various shades of drab, the catechine giving, with proper metallic salts, salmon, red, and wood colours. Some calico printers have of late, under my advice, washed with cold water pulverised catechu, which dissolves freely the tannin, leaving the catechine insoluble in cold water, which, however, being soluble in hot water, becomes susceptible of application.

Aloes.—Owing to the interesting researches of Drs. Schunck and Stenhouse upon the resin obtained from the *aloe socotorina*, and imported from the East and West Indies as well as Africa, the various colouring matters obtained by them have, of late, been employed by the French dyers for producing pinks, violet, maroons, and other shades.

Lac Dye.—Messrs. Haworth and Brooke, of Manchester, have introduced into commerce a lac dye superior to that imported from India, which, as you are aware, is prepared from stick lac. Their improvement consists in treating stick lac with weak ammonia, and adding to this solution chloride of tin, when a fine red insoluble matter is formed which precipitates. This is collected, and is ready for use.

Chlorophyll.—For many years attempts were made to fix upon fabrics the green colouring matter of leaves, but unsuccessfully, until, in 1854, MM. Hartmann and Cordillott, of Mulhouse, succeeded by the following simple process in obtaining on silk, wool, and cotton, fine green brilliant and solid colours. After having boiled a quantity of grass, so as to remove everything soluble in boiling water, it was heated with a hot caustic lye of specific gravity 1·03, this alkaline solution being then neutralized with hydrochloric acid, a fine green precipitate was

thrown down. This precipitate was then dissolved in a solution of caustic lye, to which had been previously added some phosphate of soda and oxide of tin. This mixture, properly thickened with gum, was printed and fixed by steaming. No doubt, by a slight modification in the *modus operandi*, this colour might be applied to dyeing.*

Chinese Green, called *Lo-kao*.—In 1851 and 1852, public attention was drawn, by several English gentlemen, to samples of a green colouring matter, imported from China, and in 1853, Messrs. Guinon, of Lyons, imported such quantities of the material as to enable them to dye silks for the requirements of the trade. The silks so dyed by them, under the names of *Vert-Venus*, *Vert-Azof*, and *Vert-Lumière*, were especially admired, from the beautiful green shades they assumed in artificial light; and although the price of the dye fell from £21 per pound in 1853, to £4 in 1860, these beautiful shades of green (especially under artificial light) have almost disappeared from the market, owing to the two following reasons:—first, their want of stability; and, secondly, because Messrs. Guinon, Marnas, and Bonnet, have found the following means of producing, at less cost, shades of green which also maintain this character under the influence of artificial light, *i.e.* by first dyeing their silks in Prussian-blue, and then dyeing them in an acidulated bath of carboazotic, or picric acid. It is an interesting fact to observe that, while the greens produced with indigo and picric acid appear blue in artificial light, those produced as above with Prussian blue and picric acid appear green under the same conditions. I cannot leave this interesting subject without making two further remarks:—First, Lo-kao is the only substance with which I am acquainted capable, with proper reagents, of producing the seven colours of the spectrum; secondly, that, thanks to the advanced state of chemical and botanical science, we have succeeded in producing, in Europe, the identical substance imported only a few years ago, as a great novelty, from China—and for which, but for those sciences, we should still probably have remained tributary to that empire. Thus Mr. Charvin, of Lyons, has been able to obtain Lo-kao from a weed indigenous to Europe, viz., *Rhamnus catharticus*, for which he has received, from the Chamber of Commerce of Lyons, a gold medal worth 6,000 francs.†

Murexide, or *Roman Purple*.—The colour to which I am now about to draw your attention furnishes another example of the assistance which the progress of chemical science has rendered to the art of calico printing. In 1776, the illustrious Swedish chemist, Scheele, discovered, in human urine, uric acid. In 1817, Brugnatelli found that nitric acid transformed uric acid into a substance, which he called *erythric acid*, but which was subsequently called, by Wöhler and Liebig, *alloxan*. In 1818, Dr. Prout found that the latter substance gave, when in contact with ammonia, a beautiful purple red colour, which he called purpurate of ammonia—the product known by the name of *murexide* since the researches of Liebig and Wöhler, published about 1837. These discoveries remained dormant in the field of pure science until the year 1851, when Dr. Saac observed that when alloxan came in contact with the hand it tinged it red. This led him to infer that alloxan might be employed to dye woollens red, and further experiments convinced him that if woollen cloth were prepared with a salt of tin, passed through a solution of alloxan, and then submitted to a gentle heat, a most beautiful and delicate pink colour resulted. In 1856, MM. Depouilly, Lauth, Meister, Petersen, and Albert Schlumberger, applied it as a dyeing material to silk and wool, and succeeded in obtaining red and purple colours, by mixing the murexide with corrosive sublimate, acetate of soda, and acetic acid. For printing, a mixture of murexide with nitrate of lead or acetate of zinc, properly thickened, is applied on cotton fabrics, which are then allowed to dry for a day or two, when the colour is fixed by passing them through a mixture of corrosive sublimate, acetate of soda, and acetic acid. The Roman purple style of printing has been carried out extensively by Messrs. Edmund Potter and Co.; Boyd, Sons, and Hamel; and James Black and Co. No doubt you will wonder whence such quantities of uric acid, or murexide, could be drawn to supply a demand like that which has arisen. This result has been achieved by the following process of extracting uric acid from Peruvian guano. Guano is treated repeatedly with hydrochloric acid, until all soluble matters are removed by heat and washing. The insoluble mass, which consists chiefly of sand and uric acid, is carefully treated with nitric acid of specific gravity of 1·40. When the action of the acid is completed, the mass is treated with warm water, and thrown on a filter. The filtrate, which has a yellowish colour, and contains alloxan, &c., is evaporated carefully to such a degree, that when left to cool it becomes a brownish red or violet solid, called by the inventor, *carmin de pourpre*, which is the substance chiefly used for printing, as above described. It is to the enterprising commercial spirit of Mr. Robert Rumney, chemical manufacturer, of Manchester, that is due the extensive production and application of murexide in this country.

Doubtless you are aware that alum, and cream of tartar, are used largely as mordaunts in the dyeing of silk, wool, and cotton, and that the latter substance has much risen in price, owing to the failure of the wine crops of late years; therefore, any process for economising the use of cream of tartar is a matter of importance. I am happy to state that Mr. Kuhlmann has, within the last few weeks, published in the Mémoirs of the French Academy, a paper in which he furnishes a means of attaining that end. Having first confirmed a most important observation of Mr. Chevreul's, viz., that when cream of tartar is used as a mordaunt it is decomposed into tartaric acid, which adheres to the fibre, and into a neutral tartrate which remains in solution and is lost, and that if, on the contrary, instead of using the cream of tartar as a mordaunt, it is first decomposed into tartrate of baryta, and that this salt be used as a mordaunt, in connexion with a little hydrochloric acid, the two equivalents of the tartaric acid of the cream of tartar become available, and consequently a saving of one-half the quantity of cream of tartar formerly used is effected.

In the hope that it may prove interesing to the members of this Society, I will now give some details respecting a few new processes for dyeing silk, before proceeding to treat of coal-tar colours.

Catechu Black.—The silks are first passed into a solution of salts of peroxide of iron, then into a hot soap solution containing an excess of soap, from whence they are passed into a slightly acid bath of prussiate of potash. The silks which have thus been dyed Prussian blue, are dipped in a solution of persalt of iron, having a specific gravity of 1·15, the object of which is to give an iron mordaunt to the silk. They are then thoroughly washed and passed into a bath of catechu for organzine at 203°, and for tram at 172°, the silks being worked in this bath until it is cold, so as to saturate thoroughly the iron mordaunt with the colouring principle of catechu, and thus produce a black. They are then wrung on the peg and exposed to the atmosphere for 24 hours, after which they are passed into a soap solution at 150°, washed thoroughly, and the organzine is then dipped in a bath of weak acetic acid, and the tram in one of weak hydrochloric acid; finally, the silks are passed through an emulsion of oil, well worked on the peg and allowed to dry. These last operations are intended to remove, by means of the fatty matters, the harshness which the silk would otherwise possess.

* Any one who wishes for further information on the green colouring matter from plants, will find a most interesting paper by M. Fremy, published in the *Comptes Rendus* of the French Academy, for 1860, volume 50, in which that chemist shows that chlorophyll is composed of two colouring matters called phylloxanthine and phylloxcyanine.

† For full details on this subject, see Report presented to the Chamber of Commerce, at Lyons, by the Rev. M. Hélot, M. Persoz, &c.

The following is a process for preparing dyed silks, so that when woven into fabrics these will be fit for taking the moire antique :—Two parts of pure olive oil are mixed with one of concentrated sulphuric acid, and agitated until sulphurous acid begins to be liberated. It is then well mixed with 15 parts of lukewarm water, and the whole further diluted with boiling water. The silks are then passed into this bath and then into a second similar bath, to which has been added a little free vitriol. After this, they are successively dipped in a hot bath containing a little citric acid, then into the previous No. 2, to which is added a little sulphate of alumina and a little black dye to restore to the silk any colour it may have lost during the former operations. The silks, after having been dried in the air, are ready for weaving. The object of these processes is to introduce into the silk fatty acids, the property of which is to communicate to the silk a great degree of softness, and adapt it to receive, by intense pressure, the intended moire.

I will now describe a process for dyeing silks white. The silks, after having been boiled, are first passed into a slightly ammoniacal bath, and from thence into another of water, in which has been dissolved a little French purple, and lastly, into another bath containing lukewarm water, to which is added, in successive portions, some carmine of indigo, and the silks are then dried. Many of you will doubtless remember that in my papers read here in 1851, I explained that, when the three primitive colours of the spectrum are mixed in due proportions, they produce white if reflected, and black if absorbed. The French purple gives the red; the carmine of indigo, blue; and the silk itself the required yellow.

Several improvements have also taken place in the production of maroons, greens, and Prussian blues, but time will not allow of my laying the details before you.

Colours derived from Coal Tar.—These colours are as interesting for their beauty and brilliancy as for the source from whence they are derived, and present a remarkable instance of the valuable services which abstract science so frequently renders to the material interests of society. How little did even chemists dream that a substance first perceived by Unverdorben in the year 1826, then named *aniline* by Fritsche, and discovered in coal tar about 1841, by Dr. A. W. Hofmann, would lead to the production of such magnificent colours as aniline purple, magenta, &c. There can be no doubt that it is to the interesting and learned researches of Dr. Hofmann on aniline, that we owe the possession of these splendid colours, and further, it was one of his pupils, Mr. W. A. Perkin, who produced for the first time, on a commercial scale, aniline, and then the splendid purple colour which it is susceptible of yielding. Before describing to you the process patented by Mr. Perkin in 2856 to produce his purple, allow me to lay before you an outline of the present plan followed for obtaining aniline. A carburretted hydrogen, which I mentioned to you in one of my previous papers, called "Benzine" (C_{12} H_6), and obtained by the careful distillation of purified coal naphtha at a temperature of about 186°, is treated with strong nitric acid, when a violent action ensues, which gives rise to nitrobenzine or C_{12} H_5 NO_4. To convert this compound into aniline, one hundred parts of nitro-benzine are mixed with an equal quantity of acetic acid, and 200 parts iron filings, heat is produced, and the following chemical action ensues;—

$$\underset{\text{nitro-benzine.}}{C_{12}H_5NO_4} + \underset{\text{water.}}{2\,HO} + \underset{\text{iron.}}{4\,Fe} = \underset{\text{oxide of iron.}}{2\,(Fe_2\,O_3)} + \underset{\text{aniline.}}{C_{12}H_7N}$$

The whole is then introduced into a retort, and the raw product which passes from it is mixed with a little alkali or lime, and again distilled, when aniline is obtained. This important substance is, as you perceive, a colourless fluid, which boils at 359°, has a decided alkaline reaction, and a sp. gr. of 1·028. The following is the process described by Mr. Perkin for preparing his purple. Solutions containing equivalent proportions of sulphate of aniline and bichromate of potash are mixed and allowed to stand till the reaction is complete. The resulting black precipitate is then thrown on to a filter and washed with water until free from sulphate of potash; it is then dried. This dried product is afterwards digested several times with coal tar naphtha until all resinous matter is separated, and the naphtha is no longer coloured brown. After this it is repeatedly boiled with alcohol to extract the colouring matter. This alcoholic solution when distilled leaves the colouring matter at the bottom of the retort as a beautiful bronze coloured substance, which may be considered as Mr. Perkin's commercial aniline purple. This colour, which can also be produced by oxidising aniline by other metallic salts, is slightly soluble in water, freely soluble in alcohol, and presents the remarkable property of not being affected by light, alkalies, or acids. To dye wool or silk with it, it is simply necessary to add to a hot water bath, slightly acidulated with tartaric acid, some of the alcoholic solution of aniline purple, and to work the silk in the said bath, wringing and washing it; the purple shade thus produced can be modified with roseine, Prussian blue, or sulphate of indigo. To dye cotton so as to resist the action of soap and light, the process is modified so as to form on the cotton fibre an insoluble compound of colouring matter with tannin and a metallic base. To effect this the cotton is passed for an hour or two into a bath containing a tanning substance, and then into a weak solution of stannate of soda, wrung out, passed into an acid liquor, rinsed in water, and then, like silk, dipped into an acidulated bath of purple aniline. Also cotton prepared with a basic salt of lead, or as for Turkey red, will take up aniline purple. On the 12th January 1861, another interesting process to obtain aniline purple was patented by Mr. Adam Girard. Pure red aniline (known in this country as magenta), is mixed with an equal weight of aniline, and the mixture heated for several hours to 329°, when the mass is changed to a fine purple colour, requiring only to be mixed with water and hydrochloric acid, to remove any aniline or red dye in excess, leaving the purple insoluble, but on being well washed with water, this becomes soluble in alcohol, acetic acid, wood naphtha, and boiling water slightly acidulated with acetic acid.

Whilst on this mode of producing purple aniline, I may say that blue dye may also be obtained with the above insoluble purple residue by boiling it several times with hydrochloric acid diluted, say ten parts of commercial acid to 100 parts of water, when the purple is converted into a blue dye.

Mr. Charles Lauth also published, on the 24th Dec., 1860, an ingenious method of obtaining purple aniline, which I shall describe when treating of blue colours obtained from aniline.

Red dyes obtained from aniline, called fuchsine, azaléine, roseine, &c.—The production of the fine colour, which bears the popular name of Magenta, was first observed by Mr. Natanson, in 1856, and more especially by Dr. Hofmann when preparing cyantriphenyl-diamine, by the action of bichloride of carbon on aniline. But it was Mr. Verguin who first brought it forward to the trade as a dyeing agent, and his mode of preparation, which was patented in April, 1859, by Messrs. Renard and Franc, of Lyons, is the following:—Into a glazed iron pan are introduced 100 parts of aniline and 60 parts of anhydrous bichloride of tin, and the whole is heated for 15 or 20 minutes, at a temperature of about 392°. The dark red liquor thus produced is left to cool, when it becomes thick and glutinous; it is then mixed with boiling water and filtered; to the filtrate is added chloride of sodium, which determines the precipitation of fuchsine, as it is insoluble in saline solutions. Magenta was afterwards prepared by C. Greville Williams, with permanganate of potash, and by Dr. D. Price, with binoxide of lead; nitric acid, and nitrate of mercury were also successfully employed. These different methods of preparing magenta were followed by several other patents, purporting to obtain the same results, and amongst them I may cite that taken on the 10th December,

1859, by Mr. Rudolph Heilman, in which the employment of arsenic acid is mentioned, and one also for the employment of the same agent on the 18th of January, 1860, by Dr. H. Medlock. As it is probable that this agent is the best suited for producing magenta, commercially, I will give a sketch of the process. Dr. Medlock heats two parts of aniline with one of arsenic acid to about 250°, and when the red colour is produced it is mixed with boiling water and allowed to cool. The red colour is thrown down by saline matter, washed, and dissolved in methylated alcohol, or the mass is digested in hydrochloric acid diluted with water, and the clear fluid solution is saturated with an excess of soda which precipitates the colour, while the arsenious acid is held in solu tion by the alkali. Magenta is a rather powerful organic base which is sparingly soluble in water, but its solubility is increased by the presence of an acid. It leaves a brittle mass, having a beautiful golden green metallic reflection when its alcholic solution is left to spontaneous evaporation, and this is not peculiar to magenta, as the whole of the coal tar colours, when in a high state of purity, present the same appearance. Purple aniline differs from the red, not only in its composition, which is as follows—

$$\underset{\text{Purple.}}{C_{36}H_{17}N_3O_2} \qquad \underset{\text{Red.}}{C_{36}H_{20}N_4O_4}$$

but also because the fuchsine dissolves in ammonia and in sulphuric acid with a yellow colour, and is discoloured by sulphurous acid, whilst the purple is unaffected by those reagents. Silk or wool is dyed with fuchsine by simply adding some of the colour to a slightly acidulated bath. The dyeing colour of this material is so great that 10 grains will dye 2 square yards of silk.

Of late years many attempts have been made to fix another colour obtained from coal tar, called rosalic acid ($C_{12}H_6O_3$), but up to the present time I believe all attempts have failed, with the exception of rosalate of magnesia, which was employed for some time in calico printing.

Blue colouring matters from Coal Tar.—I have already drawn your attention to the blue colouring matter patented by Mr. Girard, and carried out practically by Messrs. Renard and Franc, of Lyons. Mr. Lauth also has observed that if an alcoholic solution of red aniline, and especially azaléine, is heated with a reducing agent, such as protochloride of tin, or still better with aldehyde or hydruret of benzoïle, a blue colour is produced even at ordinary temperatures. This blue colour is soluble in water, alcohol, and acetic acid, but does not resist the action of mineral acids, alkalies, or light.

Mr. Willm has recently published an interesting paper on this aniline blue, which not only shows how aldehyde acts, but exhibits the composition of the blue itself.

$$\underset{\text{Azaléine.}}{2\,(C_{36}H_{20}N_4O_4)} + \underset{\text{Aldehyde.}}{5\,C_4H_4O_4} + \underset{\text{Water.}}{8\,HO}$$

$$= \underset{\text{Blue or Oxyphenylanilide.}}{3\,(C_{34}H_{11}NO_3)} + \underset{\text{Acetate of Ammonia.}}{5\,C_4H_3(NH_4)O_4}$$

Therefore the triamine azaléine has been transformed into a monamine blue, by a new chemical reaction, for aldehyde not only acts as a reducing agent, but converts a part of the nitrogen into ammonia.

Bleu de Paris.—Recently, Messrs. Persoz, de Luynes and Salvétat called public attention to a new blue which they had produced, and to which they gave the name of Bleu de Paris; this they prepared by heating for thirty hours, in a sealed tube, at a temperature of 356°, one part of anhydrous bichloride of mercury with two parts of aniline. The blue thus produced can resist the action of weak acids and alkalies, but assumes a red hue when acted on by these agents in a concentrated state. Sulphurous acid has no action upon it, and it dyes animal fibres with facility.

Bleu de Mulhouse.—MM. Gros-Renaud and Schaeffer have lately published an interesting process for obtaining from the red aniline, called azaléine, a purple and a blue. It consists in dissolving in a litre of boiling water, 50 grammes of white gum lac in powder, and 18 grammes of carbonate of soda, to which is added 50 grammes of an alcoholic solution of azaléine. After an hour's ébullition, the red colour is transformed into the Bleu de Mulhouse.

Azuline.—This beautiful blue colour, which resists the action of the strongest acids, and which was introduced into this country at the latter end of 1860, by Messrs Guinon, Marnas, and Bonnet, of Lyons, is prepared by them from phenic acid, and, when pure, presents itself under the form of copper-bronze coloured crystals, soluble in alcohol, to which they communicate a magnificent blue colour, slightly tinged with red. The following is the process for dyeing silk and wool:—To an acidulated lukewarm bath of water an alcoholic solution of azuline is added, and the silk or wool worked in it until it is of the required shade. It is then transferred to another bath of boiling water, strongly acidulated with sulphuric acid, when the purple colour is dissolved, leaving a most brilliant and permanent blue upon the material. The dyed silk or wool is washed repeatedly, passed through a bath containing a little tartaric acid, and dried.

Chinoline Blue.—Mr. C. Greville Williams introduced in the spring of last year a fine blue colour, which he obtained by boiling together a substance derived from quinine or cinchonine, called chinoline, with iodide of amyl. The resulting product is boiled with water and then with potash for a quarter of an hour, filtered to separate the resinous matter, when a gorgeous blue is obtained, with scarcely any shade of red. This colour is so fugitive that its use has ceased.

Green Colours from Aniline.—Although it has been known to chemists that aniline would yield a green colour under certain oxidising agents, up to the present time all efforts to dye silk or wool commercially with it have failed, but to avoid having to refer to this green colour again I may mention that Messrs. Samuel Cliff, Charles Lowe, and myself, patented, on the 11th of June, 1860, a most easy and practical method of producing it under the name of *Emeraldine*, on cotton fabrics, specimens of which I have the honour to show you. The process consists in printing an acid chloride of aniline on a cotton fabric prepared with chlorate of potash, and in a few hours a beautiful bright green gradually appears, which only requires to be washed. If the green fabric is passed through a solution of bichromate of potash, this colour is transformed into a dark indigo blue, called by us *azurine*.

Naphthaline Colours.—The beautiful solid hydro-carbon naphthaline, which has yielded such a long category of substances to the chemists, has up to the present time yielded nothing of practical importance to the dyer, with the exception of a case which I shall mention presently. From it the following coloured derivatives have been obtained, namely, chloroxynaphthalic acid, perchloroxynaphthalic acid, carminaphtha, ninaphthalamine nitrosonaphthalin, naphthamein, and a body of a purple colour. It is to Mr. Perkin that we owe the knowledge of several of these substances and their colour-giving properties. In my laboratory a fine purple colour has been obtained from naphthalin, which dyes with facility silk and wool, and the process is so far perfected as to enable me to show you some silk dyed and a piece of calico printed with it.

A few months ago the scientific world were startled by the announcement, from a French chemist named Z. Roussin, that he believed he had discovered the means of making from naphthaline the important colour-giving principle which I have already mentioned to you when speaking of madder called alizarine, and what strengthened his belief was, that he thought he had succeeded in removing two equivalents of oxygen from binitronaphthaline, and transforming the nitrogen thereof into ammonia, leaving, as a residue, alizarine, as seen by his formula:—

*** Those who may wish for further information on the subject of coal tar colours, should consult the number for October, 1861, of the quarterly journal of the Chemical Society, which contains a valuable paper by Mr. W. A. Perkin.**

Binitronaphthaline ...	...	C_{12}, H_6, N_2, O_8
Minus oxygen ...	...	$- O_2$
Plus hydrogen ...	...	$+ H_6, H_2$
	EQUALS	
Alizarine ...	...	... C_{12}, H_6, O_6
Plus ammonia ...	...	N_2, H_6
Plus water, ...	...	... $2HO$

The simple process which he devised to obtain a crystalline substance which gave a red colour with an alumina mordaunt, consists in dissolving slowly binitronaphthaline in concentrated sulphuric acid, and raising the temperature gradually to 392°, when he adds granulated zinc in successive small portions. After a short time sulphurous acid is given off, and the conversion of binitronaphthaline into a red colouring matter is effected. All that is now required is to dilute the liquor with eight or ten times its volume of water, and carrying it to the boil, filter, and allow the whole to cool, when Mr. Roussin's so-called alizarine deposits under the form of fine red or orange coloured crystals. Although this product possesses some properties similar to those of alizarine, it differs from it in many of its chemical reactions, and also because it does not furnish the purple and chocolate colours given by alizarine with iron, and iron and alumina mordaunts. Still these results, arrived at by Mr. Roussin, are so remarkable, that it is to be hoped that he will persevere in his endeavours to solve this interesting problem.

I cannot conclude this part of my paper without drawing the attention of those interested in the subject of colours, to a series of valuable papers, which have recently been published in the memoirs of the Institute of France, by my eminent and learned master, M. Chevreul, on the comparative affinity of various colouring matters for different fibres, on the influence of various mordaunts, on divers colouring matters, and, lastly, on the influence of the solar light on such dyed fabrics.

CALICO PRINTING.

The art of calico printing depends upon so many branches, of mechanical as well as of chemical science, that it is impossible for me to give detailed information of all the improvements which every department of this manufacture has undergone, during the period embraced by this lecture, but I shall draw your attention to a few of the prominent points that have come under my notice.

Engraving of Rollers.—This branch of calico printing has made great progress. Not only have the engravings acquired sharper outlines and finer details, but the methods of engraving have greatly multiplied. I may cite as instances the application of the principle of the pentagraph, by Messrs. Smith, so as to trace patterns on the surface of rollers. Also, calico printers have extensively availed themselves of Mr. Locket's improvements for producing the groundwork of prints, or as they are termed "covers," by applying "eccentric engraving," or etching, which produces with facility most complicated patterns on a varnished roller, by means of a diamond point guided by machinery. Another improvement, highly interesting in a scientific point of view, is the application of galvanism to the diamond tracer. By combining the galvanic action with an eccentric motion, most beautiful and delicate engravings may be produced. This is done by tracing the pattern with varnish on a zinc cylinder, which is so placed in the engraving machine that as a needle passes over its surface and comes into contact with the zinc, the galvanic current is established, and by simple machinery causes the diamond to trace the corresponding pattern on the copper roller. The communication is so rapid and precise that a great saving of time is effected. But if mechanical art has greatly assisted the engraver, chemistry has rendered him equally important services, by enabling him to abandon costly and cumbrous modes of impressing by force the designs on the cylinder, substituting for them a great number of etching processes. By some of these processes, as by every other addition to the resources of the engraver, an entirely new and beautiful class of engraving is produced, unattainable by any other known means. For instance, owing to various improvements, rollers of 43 inches in circumference and 44 inches long have been introduced, enabling the calico printer to produce cheaply large furniture patterns.

En passant, I wish to call your attention to an application which has been made of a process greatly admired by many of you at the Exhibition of 1851, invented by Mr. John Mercer, the eminent calico printer, by which the beauty of dyed and printed goods was increased by passing the cotton fabrics through a strong solution of caustic lye, and afterwards through a weak solution of sulphuric acid, and then thoroughly washing. If this process has not been generally adopted, it is no doubt owing to the contraction which the cotton fibres experience under the above chemical influences, but the increased strength which the fibre thus acquires has been turned to good account, by enabling the printer to use it as a substitute for what is technically termed the "blanket" that is an endless cloth which passes over the engraved rollers with the goods to be printed. This material is found by its strength to resist better than most others the heavy strain which the blankets have to undergo during printing.

Singeing.—I shall here also allude to two improvements effected by Mr. John Thom, of Manchester. The first, applicable to all kinds of cotton or woollen fabrics, destined for printing or dyeing, consists in an improvement in the singeing or removing the nap from fabrics. The usual mode is to pass the fabrics either through a gas flame, or over a semi-circular heated iron plate. In the latter case, however, a large amount of fuel was wasted in maintaining the heat of the plate, owing to the free radiation of heat into the atmosphere, and to its absorption in the currents of cold air in contact with the plate. Mr. Thom's invention remedies these defects, by enclosing the plate under a brick arch, so that no air can enter the chamber except that which passes with the piece, and that limited quantity is, by a proper arrangement of flues, conducted into the furnace which heats the plate. The drawing which I have the pleasure to show you will fully explain this arrangement.

Sulphuring.—The second improvement of Mr. Thom was devised some years ago, but it is only recently that it has come into general use amongst printers. It is especially applicable to mixed fabrics, such as *mousselines-de-laine*, which require, after they have been singed and before they are printed, to be bleached. This was formerly effected by hanging, for several hours, the moist pieces in chambers filled with sulphurous fumes, and is now performed by Mr. Thom's process in a few minutes, by passing them over a number of rollers confined in a chamber filled with the same vapours.

Thickening Substances.—It will be readily understood that it is necessary that the mordants or colours to be printed, should be of sufficient consistency to remain on those parts of the fabrics when they are left by the rollers, so as to produce sharply-defined patterns, and as a great variety of chemical products are employed a great variety of thickeners becomes also necessary. Thus flour, starch, farina, various natural gums, albumen, lactarine, gluten, and several preparations of flour and starch called calcined farina, and patent gums are used. For details of the improvements effected in patent gums I must refer you to the lecture which I had the honour to deliver, on the 21st December, 1852, before this Society.

Madder Styles.—Although there has been no marked change in this important branch of calico printing, still there are one or two departments in which considerable improvements have been effected, to which I desire to draw your attention, and to enable you better to understand the nature of these improvements, I shall describe them in the order in which they come into play in the production of this class of goods. The first is the improvements in patterns, arising out of the before-mentioned advances in the art of engraving. Secondly, a saving in the quantity of mordant used; for the fact which I have

already stated with reference to commercial alizarine, viz., that weaker mordants are required, has been proved by Mr. Pincoff to hold good with all the other preparations of madder, the strength of the mordant required to obtain the same intensity of shade being less, in proportion as the colouring matter is purer. It is also advisable that I should here state that the mordants generally used for madder styles, are the pyrolignites, or acetates of iron and alumina, which under the influence of "ageing," to be described presently, are so decomposed or modified as to leave on the cloth, either an insoluble oxide or subsalt, which becomes the intermediate agent for fixing on the fabric the colouring matter called alizarine, iron giving from a dark purple to a light lilac, alumina from a dark red to a pink, and a mixture of these two mordants a variety of chocolate tints. Thirdly, the most important improvement which has taken place in this branch of printing, viz., a great saving of time and labour in the fixing of mordants by ageing, was first practically carried out by Mr. Walter Crum, the eminent scientific calico printer. Dr. Schunck says that, "On the proper ageing of printed goods depends, in a great measure, the success of many styles; should a room be too hot or too dry, imperfect fixation of the colour ensues, and meagre and uneven tints are obtained in the subsequent operations. To give a further idea of the importance of this step in calico-printing, I may state that 'ageing-rooms' as they are called, are in several print works of enormous dimensions, and are generally separate buildings. Those of Messrs. Edmund Potter and Co., and Messrs. Thos. Hoyle and Co., may be particularised as forming quite a feature in their works." The process of "ageing" in calico printing is that by which a mordant, after being applied to a cotton fabric, is placed in circumstances favourable to its being completely incorporated with, and fixed in the fibre. It has generally been found desirable that calico printed with a mordant, should, before dyeing, be exposed to the atmosphere for some time in the ageing-room in single folds, which, generally speaking, requires several days, the object being, as before stated, to liberate the acetic acid from the acetates of iron or sulpho-acetate of alumina, and to oxydise the oxide of iron. It was for many years believed that oxygen was the only necessary agent, and although some printers had observed that moisture facilitated the process, this fact was not generally known until Mr. John Thom, of Manchester, claimed the introduction of moisture as an important agent in the phenomena of ageing, in a patent which he took out in 1849. The first printer, however, who, as far as I am aware, practically applied this principle, was Mr. Walter Crum, F.R.S. But I cannot better show you the great saving effected by the judicious employment of steam in this process, than by giving you, in Mr. Crum's own words, the particulars of the plan adopted at Thornliebank print-works:—

"A building is employed 48 feet long inside and 40 feet high, with a mid wall from bottom to top running lengthwise, so as to form two apartments each 11 feet wide. The manner in which they are fitted up will be understood by reference to the drawing.

"In one of these apartments the goods first receive the moisture they require. Besides the ground floor, it has two open sparred floors 26 feet apart, upon each of which is fixed a row of tin rollers, all long enough to contain two pieces of cloth at their breadth. The rollers, being threaded, are set in motion by a small steam-engine, and the goods to be aged, which are at first placed in the ground floor, are drawn into the chamber above, where they are made to pass over and under each roller, issuing at last at the opposite end (on the right-hand side of the drawing), where they are folded into bundles on one (at a time) of the three stages which are placed there. These stages are partially separated from the rest of the chamber by woollen cloths.

"While the goods are traversing these rollers, they are exposed to heat and moisture, furnished to them by steam, which is made to issue gently from three rows of trumpet-mouth openings. The temperature is raised from 80 to 100 degrees, or more of Fahrenheit—a wet-bulb thermometer indicating at the same time 76 to 96 degrees, or always four degrees less than the dry-bulb thermometer. In this arrangement 50 pieces of 25 yards are exposed at one time, and as each piece is a quarter of an hour under the influence of the steam, 200 pieces pass through in an hour. Although workpeople need scarcely ever enter the warmest part of this chamber, a ventilator in the roof is opened when there is any considerable evolution of acetic acid.

"The mordant, as already explained, does not become fully "aged" by this process alone, although as much so as if it had hung a whole day in cold air. It has received, however, the requisite quantity of moisture (about 7 per cent. of the weight of the printed piece), and is thereby enabled, if an iron mordant, to take oxygen from the air, and to become changed (with time) into the sesquiacetate and sesquihydrate of iron. In order to be sufficiently aged, it must be left one or two, or even three days in an atmosphere still warm and moist.

"It had fortunately been ascertained long before, at Thornliebank, that exposure in single folds after moistening was not necessary. Mr. Graham's experiments on the diffusion of gases through small apertures had served to suggest that for the absorption of the small quantity of oxygen required, the goods might as well be wrapped up and laid in heaps. Accordingly, in the operation in question, the moistened goods are carried in bundles into the building on the opposite side of the mid-wall already mentioned, and deposited there upon the sparred floors which are placed there at heights corresponding with the stages in the first apartment on which the goods are folded down. Upon these floors seven or eight thousand pieces may be laid at a time, and as each piece is 25 yards long, 100 miles is therefore the quantity that can be stored at once. It is necessary, of course, that an elevated temperature, and a corresponding degree of moisture, be preserved in the storing apartments day and night, and 80° Fahr. is sufficient, with the wet bulb at 76°. To effect that object a large iron pipe is placed along the ground-floor underneath, and moderately heated by steam, while a row of small jets in the same position are made to project steam directly into the air of the apartment. The whole building is defended from external cold, and consequently from condensation of steam, by a warmed entrance room, and by double windows and double roof. Small steam pipes are also placed at other points where they seem to be required; and the apartment with rollers is specially heated, when not in use, by a couple of steam pipes, which are placed under the ceiling of the ground floor.

"The process of ageing, as thus detailed, was in operation at Thornliebank, in the autumn of 1856. About a year afterwards it began to be adopted by other printers, and now it is already in use at, at least, sixteen different printing establishments in Scotland and in Lancashire."

Fourthly, *Dung Substitutes*.—During the last few years the various dung substitutes, such as the double phosphate of soda and lime, the arsenites and arseniates of soda, and the silicates of soda have completely taken the place of cow dung in the process of dunging, that is to say, a process which consists in passing the mordanted and aged cloth into weak and hot solutions of the above-named substances, with the view of fixing thoroughly the mordant in the cloth, and removing any excess that may have been used, without allowing it to fix itself on the white, or unmordanted parts. By the introduction of these dung substitutes, and improved dunging vats, a great saving of time, labour, and expense has been effected. Thousands of pieces are now done in the same vat, where formerly as many hundreds only could be so heated.

Fifthly, *Washing Machines*.—As madder goods have to be thoroughly washed, not only after this operation, but also after dyeing, several improved machines have been

introduced in the trade. I shall only here mention those of Messrs. Mather and Platt, Mr. Furnival, Mr. D. Crawford, the last of which is much used for steam work and loose colours, and especially that of Mr. Thomas Whittaker, which I have heard highly praised by madder and garancine printers, and a model of which I have the pleasure to lay before you, through the kindness of Messrs. Christopher Whittaker and Co. To give you an idea of the vast capabilities of some of those machines, I will cite the following fact mentioned by Messrs. Whittaker:—"Our machine will wash 6,000 yards for all kinds of dyeing purposes, and 12,000 yards for all bleaching purposes, per hour (which only requires the attention of a person of 12 or 14 years of age)."

Sixthly. After the madder goods have undergone the above improved processes they are ready for the dyebeck, where the mordants assume the colours for which they are adapted. Here, also, a slight improvement has been effected, the advantage of which is a saving of time; as it now requires for saturating the mordants with alizarine only 1¼ hours for garancine and 2 hours for madder. After leaving the dyebecks the pieces are thoroughly washed in the improved washing machines, but as the white parts (or those not mordanted) are still soiled and the colours dim, it is necessary to pass the pieces for half an hour into a rather strong soap solution heated to 180°, when the loose dye is not only removed from the white parts, but also from the parts on which colour has been fixed. To finally brighten the colours and completely clean the white portions, the pieces are passed into a weak solution of what is called "chimic," or an alkaline hypo-chlorite of soda, with a little sulphate of zinc, until the desired effect is obtained, but latterly this process has been improved by passing the goods rapidly into chimic and then through a steam-chest. As the pieces have not yet, however, a commercial appearance, they further undergo what is called finishing, that is, the pieces are passed through a solution of sour flour (flour which has been fermented for several weeks), starch, farina, &c., and then between rollers, dried, and lastly through calenders, the object of which is to fill up the interstices of the fabrics and to give them a glossy appearance. Much improvement has also taken place in this department of printing by the introduction of new machinery, especially in the methods of adapting the finish to the various markets of the world. I wish to take the opportunity of impressing upon printers the importance of dispensing, as much as possible, with the use of sour flour, and confining themselves to that of starch or farina, with the addition of about 1 ounce of sulphate of zinc per piece, for the purpose of diminishing the risk of mildew and other stains, to which a low class of printed goods are liable, during their transit in tropical climates, and especially those dyed with common garancine, bark, sumach, and peachwood.

In concluding my remarks upon madder, I wish to draw your attention to these beautiful examples of madder styles, for which I am indebted to Messrs. Symonds, Cunliffe, and Co., and of garancine styles to Messrs. Wood and Wright.

Indigo.—Most of the styles obtained with this valuable dye-stuff are due to the mixture of printing and dyeing, and only a few improvements have been effected herein, to my knowledge, during the last ten years.

First, the usual method of dyeing cotton, plain or self blue, is to fill with water large stone vats, and dissolving in them two parts of sulphate of protoxide of iron, adding one part of finely ground indigo, and then three parts of hydrate of lime. After having well stirred the whole for several hours, pieces of calico which have been hooked on a frame and dipped in lime water, are then plunged for 15 minutes into the vat, when the blue indigo which has been converted into white indigo by the protoxide of iron, and rendered soluble by the excess of lime, fixes itself on the fibre, and, on the exposure of the latter to the atmosphere, re-absorbs oxygen and becomes blue. When white patterns are required, the pieces are printed before dyeing with what is called a "reserve," that is, a composition which prevents the colour from fixing itself on the fibre; the chief ingredient for that purpose is sulphate of copper, which acts by prematurely oxydising the indigo, and thus preventing its fixation. In both these cases the pieces are passed through a weak sulphuric acid bath to perfectly fix the indigo, and formerly the copper thereby liberated from the fabrics was completely lost. Mr. Joseph Leese has recently devised a method of saving this valuable metal. To effect this, the diluted solution of sulphate of copper is made to filter through vessels containing wrought-iron turnings, the acid thus dissolving the iron, which may be used as sulphate of protoxide of iron for future operations, whilst the copper deposited on the excess of iron employed may be used, if thought fit, to manufacture again sulphate of copper. To give an idea of the importance of small savings, I may state that this ingenious, but apparently trifling improvement, saved at least £3,000 a-year to one firm.

Secondly. A few years ago I was able also to effect an economy in this branch of calico printing, which consisted in extracting from the cold indigo vats which were considered by the printer to be exhausted, a considerable percentage of the indigo originally employed. Having observed that a green insoluble flocculent matter, which remained in the vats, and which was considered by chemists and printers to be simply oxide of iron, was in reality a compound of indigo and iron, I devised the following simple means of extracting the indigo therefrom:—The green pulp alluded to was conveyed from the several exhausted indigo vats into a general receptacle, and there mixed, first with a small quantity of hydrochloric acid, so as to remove the excess of lime, allowing the green pulp to settle, and running off the liquor. The so purified green pulp was then treated with strong hydrochloric acid, when chloride of iron was produced, and the indigo liberated, which required only to be washed to become again fit for use.

Thirdly. Although the printing of indigo offers great difficulty, still several printers have recourse to it from time to time, with greater or less success. The usual method of printing indigo consisted in mixing finely-powdered indigo with orpiment, or protochloride of tin, with a caustic alkali, and this process was further facilitated by printing the pieces in an atmosphere of coal gas, as devised by Mr. Bennett Woodcroft, the present learned officer of the Great Seal Patent Office, and carried out by Messrs. T. Hoyle and Sons, of Manchester. But of late years Mr. Joseph Leese, of Messrs. Kershaw, Leese, and Co., has succeeded in applying the following method, first devised by Mr. Fritzsche. The indigo is finely ground, and reduced to an impalpable powder, and then mixed with glucose, lime, and caustic soda, in such proportions as are needed to produce the shade of colour required. These materials are all mixed cold, and after the cloth is printed with the mixture it is passed through a steam chest, in which it is exposed for the space of from 30 to 60 seconds. In this short period the indigo is completely reduced and rendered soluble, when it enters into the fibre, and on emerging from the steam chest it becomes oxydised and fixed by exposure to the atmosphere, or the pieces may be immersed in a solution of an oxydising agent, such as dilute sulphate of copper, after which they only require to be washed, dried, and finished.

I am not aware of any marked improvement in the style of printing called "spirit colours," but in that of "steam colours" considerable advance has been made since 1851, rather, however, in a mechanical and artistic, than in a chemical point of view. Thus, it was owing to certain mechanical improvements that Mr. Robert Kay, calico printer of Manchester, and his workmen, had the honour of obtaining the gold medal at the Paris Exhibition of 1855. The beautiful furniture patterns which he exhibited there were the result, not only of artistic skill, and of improved machinery, by which twenty colours

can be printed at once, but also of an invention patented by Mr. J. Burch, of Macclesfield, of which Mr. Kay availed himself with great tact. Of course you must be aware that, in order to produce light shades of colour, the darker shades are diluted with gum-water, or reducing liquid; this was the work of the colour mixer, and, therefore, to produce four colours and four shades of each colour, sixteen rollers would be required. Now the invention of Mr. Burch consists in reducing the colour upon the cloth during the process of printing. The pattern of the paler shades of each colour in a chintz design being engraved on one roller, an impression in gum-water or reducing liquid is given off upon the cloth first, the impression of the other rollers then following in the usual order; where the different colours fall upon the gum-water a lighter shade is produced, owing to the dilution of the colour on those parts, which effect may be still further heightened, by more lightly engraving the corresponding parts of the colouring roller, so that a less quantity of colour shall be given off. The application of this process to furniture styles, first by Mr. Kay, and of late by Messrs. Littlewood and Wilson, and other large calico printers of Manchester, together with the substitution of the large rollers above mentioned, for block printing, has produced quite a revolution in furniture styles.

Pigment Printing.—This style remained for many years in a dormant condition, owing, first to the difficulty of finding a proper fixing agent, and then to the insufficient variety of pigments, for it was necessary to find a substance which would give the pigment the required consistency, and at the same time cause it to adhere to the cloth. Artificial ultramarine was the first pigment attempted to be printed, and in 1843 india-rubber dissolved in naphtha was proposed as a fixing agent for it, but owing to the danger of fire, and for other reasons, this method was abandoned. In 1847, egg albumen was introduced into this country for the same purpose, but owing to the coarseness of the ultramarine, and its high price, which was about £8 per lb. (it is now 1s. 3d.) the progress of this mode of printing was greatly retarded. In 1849, Mr. R. T. Pattison, of Glasgow, patented the use of caseine from milk, which he called lactarine, which promoted the use of ultramarine, buff, and stone pigments in shawl printing. About the same period, another fixing agent was introduced, viz., albumen obtained from blood. The style of pigment printing, however, received an extraordinary impetus in the spring of 1859, when the purple aniline of Mr. Perkin was successfully introduced by Messrs. James Black and Co., of Glasgow, and the French purple of Messrs. Guinon, Marnas, and Bonnet, of Lyons, by Messrs. Walter Crum and Co., Dalglish and Co., Boyd and Hamel, Inglis and Wakefield, Heys, &c., and the splendid mauves and purples which astonished the world by their beauty, fastness, and brilliancy, were obtained by printing albumen or lactarine on muslin, and fixing the same by coagulating it by the action of steam. The pieces were then passed into the dyebeck, containing in solution Mr. Perkin's aniline purple, or Messrs. Guinon, Marnas, and Co.'s French purple, first dissolved in oxalic acid, and then added to a slightly ammoniacal bath, when the albumen or lactarine took up the colour and fixed it on the cloth, the pieces being then thoroughly washed, to remove any excess of colour. In the middle of the same year, a beautiful green pigment, which had been patented in 1858 by Mr. Guignet, was introduced, and as it is extensively employed, it may be interesting to know how this green oxide of chrome is produced. Three parts of boracic acid are intimately mixed with one part of bichromate of potash and a sufficient quantity of water to form the whole into a thick paste. It is then introduced into a furnace, and heated to a dull red heat, when a borate of potash and a borate of oxide of chrome are produced. The mass is allowed to cool, and is then thrown into cold water, when the borate of potash dissolves, and the borate of oxide of chrome is decomposed. The hydrate of oxide of chromium, $Cr_2O_3 + 3HO$, falls to the bottom as a magnificent green powder, which requires only to be well washed and drained to be ready for use. The peculiarity of this green, as well as of one prepared by Mr. Arnaudon, of Turin, from phosphate of ammonia and bichromate of potash, is that, besides being of a brilliant green, they maintain this colour by artificial light. In the month of November, 1859, the magenta colour, or fuchsine, of Messrs. Renard, was also introduced to the printing trade, and fixed by the above described method. The beautiful pinks thus obtained were soon followed by the application of roseine, azaléine, and other aniline reds. In May, 1859, a further improvement was made, which reduced the cost of applying these colours to muslins, by Mr Walter Crum, who made the curious observation that if the gluten of wheaten flour is allowed by exposure to the atmosphere to fall into a semi-fluid condition, it dissolves easily in a weak solution of caustic soda, which solution he used as a substitute for albumen or lactarine. About the same time, Mr. Scheurer-Kestner also introduced the use of gluten by the aid of weak acids, and Messrs. W. A. Perkin, and Matthew Gray, of the Dalmarnock Printing Company, proposed to fix the coal tar colours on fabrics by means of a lead soap.

Early in 1860 calico printers succeeded in printing the aniline colours directly with the animal mordaunts, instead of dyeing the mordaunts after the latter were printed and fixed, and thus were enabled not only to print a variety of colours on the same piece, but also to effect a great saving and simplicity in the operation. By this means the pigment style was fully developed, and an entirely new class of prints was introduced into this market.

Owing to the great extension of this style, the cost of the animal mordants employed became such a serious consideration as to cause anxious search for other means of fixing the colours, and Mr. Charles Lowe and myself having observed in 1856 that tanning matters would precipitate and render insoluble certain coal-tar colours, and having further observed, at the end of 1859, that tannin, when printed on cloth and submitted to the action of steam would become fixed, and serve as a mordant for the coal-tar colours, we took out a provisional specification on the 10th of December, 1859, for fixing the insoluble tanning compound formed by adding a solution of gall-nuts to a coal-tar colour, on cloth prepared with oxide of tin or alumina, or other metallic oxides. For various reasons this patent was not proceeded with, but in the early part of 1861 Mr. Gratrix, with the intelligent and persevering assistance of Messrs. Butterworth and Brooks, of Manchester, succeeded in fixing aniline purples, which, though faster against soap than those printed with albumen, did not so perfectly resist the action of light. The first process used by Mr. Gratrix was, with very slight modification, the same as that described above, but his second process, which I think he preferred, was the following:—He took cloth prepared with oxide of tin, such as is generally used for steam colours, and after having printed it with a gall-nut solution, submitted it to the action of steam, when the tannin became fixed and insoluble; the pieces were then passed through a dunging liquor, washed, and then into a beck containing aniline purple mixed with a little acetic acid. As the bath was gradually carried to the boil, the colour fixed itself on the tannin, and thus produced the print, but as the whites were rather soiled, the pieces were passed into a weak acid bath, or through a weak solution of printing clearing liquor, such as is used for garancine.

Early in 1860, Mr. John Lightfoot also took out a patent to fix colours, especially those from coal-tar, by various means, the chief of which was tannate of gelatine. In 1861 patents were secured by Messrs. Pattison, Miller, and Nathaniel Lloyd, and J. G. Dale. The last of these patents is, in my opinion, one of the best which have been taken out for that purpose, and is successfully worked by Messrs. Littlewood and Wilson, of Accrington. The characteristic feature of this process is the employment of

tartar emetic as the agent for fixing the aniline purple on the fabric.

It is to be regretted that the beautiful colours obtained from coal-tar should be exposed to injury in public estimation, owing to certain parties printing them with starch only, by which they are so loosely attached to the fabric, that a slight washing in pure water will entirely remove the colour and leave nothing but white cloth. By such means the reputation of this style of printing is being rapidly destroyed, and these colours, which might otherwise become a valuable addition to the printers' repertoire, are likely to lose altogether the favour of the public. This subject is so important that I cannot refrain from making another remark, viz., that if the use of coal-tar colours were properly encouraged, they would doubtless gradually decrease in price, and this country, instead of being tributary to others for its dyestuffs, would in time become the purveyor of dyeing materials, or of the substances yielding them, to the whole world.

I cannot conclude this paper without calling your attention to the immense extent to which calico printing is carried out, and the wonderful progress it has made. Thus in 1830 about 2,000,000 pieces were printed. In 1851, according to a lecture delivered before this Society by Mr. E. Potter, M.P., the estimated quantity of goods exported was 6,465,000 pieces, and the same authority estimates that in 1857 the export of printed calico amounted to about 27,000,000 of pieces.

DISCUSSION.

The CHAIRMAN said it was impossible to notice, or even to glance at, the various subjects of interest which had been brought before them. Dr. Calvert had shown in a striking manner what chemistry could do when applied to the arts, and had pointed out the great extent to which one important branch of industry had been affected by it. He had shown them also the great variety of ways in which, during the last ten years, organic chemistry had been applied to the printing, dyeing, and other industrial operations of the calico works of this country. He was sure the specimens by which the paper was illustrated would be appreciated by everyone, and would commend themselves to the attention of all present, more especially the remarkable results which had been obtained from coal tar. The extraordinary manner in which that hitherto useless product had been made to yield forms and colours which delighted the eye, showed at once what was to be effected in this field of science. The remarkable results obtained from naphthaline must also excite the interest of all who heard them. He would say no more, but call upon gentlemen to contribute still further to the interest of the meeting by their remarks.

Mr. WENTWORTH SCOTT said, in relation to aniline-red, it was, he believed, the general impression that it could only be produced by the action of oxidising agents upon aniline, its formation by other means having scarcely been even hinted at. He begged, however, to exhibit a specimen of the colour produced by heating aniline (without the intervention of any oxidizing agent at all), mixed with pure sand and pieces of pumice-stone, in a sealed tube for several days, and under a slight pressure. The temperature employed was about 220 degs. Fahr., but the process, although curious in a scientific point of view, was of no practical value, being very uncertain. On the subject of naphthaline colours he felt himself more at home, having devoted his attention to them for a lengthened period. About six years ago, viz. in 1856, he attempted to form alizarine artificially from binitro-naphthaline, and obtained a brilliant red-colouring matter, which, early in 1857, he showed to his friends Dr. B. W. Richardson and Dr. J. Forbes Watson. This red colour (which he provisionally named "dianthine," from the carnation tint of its alcoholic solution), was obtained by a process differing in many respects from the more recent one of M. Roussin. He considered that some hydrocarbon, like sulphonaphthalic acid, or naphthaline itself, should be added to the acid solution of binitro-naphthaline as well as a reddening agent, and that M. Roussin employed too high a temperature. Mr. Scott further showed several specimens of wool dyed at Huddersfield with madder, and his own imitations of the same produced with "dianthine." He considered that more than one substance resulted from the process just mentioned, and thought he had detected in the dianthine, by means of the microscope, crystals of true alizarine. Dianthine, when treated by certain oxidizing agents, and afterwards with alkalies, such as ammonia, in the presence of alcohol, afforded another colour of a scarlet tint; a weak solution of which he begged to hand round for inspection. Those acquainted with the colour of a solution of alizarine would here see a resemblance. These colours, he remarked, in conclusion, would be practically tested in the course of the present year.

Mr. THOMAS WINKWORTH did not rise to discuss this subject, but merely to express his hope that his friend, Dr. Calvert, who, for want of sufficient time, had not had a fair opportunity of laying before the Society this evening many details of this copious and interesting subject, so generally important, but particularly so to the manufacturers of textile fabrics, would, at a later period of the session, do them the favour to renew his revelations. At that time many foreigners interested in manufactures would, in all probability, be in London as commissioners or jurors at the ensuing International Exhibition, and he was sure they would be pleased at an opportunity being afforded them of meeting a gentleman who was so eminent in the branch of science to which he had devoted himself, and who had made so many discoveries in the applicatien of chemistry to the arts, some of the results of which they had around them in the room. He was aware that Dr. Calvert had great demands upon his time in the neighbourhood in which he resided, but at the same time he was sure that he would put himself even to inconvenience if, by so doing, he could meet the wishes of the Society in this respect.

Mr. GEORGE WALLIS said there was one fact in connection with this question which would be interesting to the members of the Society, inasmuch as they might expect a very excellent illustration of the progress in science as applied to calico printing in the forthcoming International Exhibition. Being at Manchester during the meeting of the British Association there, he had induced his friend Mr. Rumney to undertake a complete illustration of the various substances used in calico printing, and particularly those which had been discovered since 1851. That having been undertaken by Mr. Rumney, the meeting might rest assured that it would be well done, so that those who were interested in this subject would have the opportunity of going step by step through the illustrations of the very excellent paper they had heard this evening. He regretted that he had forgotten till that morning that this paper was to be brought forward, or he should have looked up some notes which he had made upon calico printing in the United States—not that he could have added anything to the chemical part of the subject, but there were many ingenious labour-saving machines in calico printing which he had seen in operation in America, of which he thought a description might well be brought before the public. He had not seen any of those machines in use in this country, the descriptions of them were buried in the depths of a blue book, in Mr. Whitworth's and his own report upon the Exhibition of Machinery in America in 1853; and he thought it might be of service if at some future time he took an opportunity of bringing this subject before the attention of the Society, because in many instances the labour-saving character of those machines was very great, and although in England labour was plentiful and comparatively cheap, they would nevertheless show the expedients which an ingenious people had adopted to supply by mechanical means the wants of hand labour.

Mr. JONES mentioned that a Roman Catholic mission-

ary had sent to the Chamber of Commerce at Lyons, in 1857, a detailed account of the dye Lo-kao, and he mentioned 5s. per ounce as the price he paid for the specimen forwarded. He also explained that it was manufactured from the bark of the wild vine, and was treated in its process of manufacture like the indigo plant.

Mr. Quin, as superintendent of the chemical department at the forthcoming exhibition, could bear his testimony as to what might be anticipated from the illustrations of calico printing by Mr. Rumney, as mentioned by his friend Mr. Wallis.

The Chairman said they were all indebted to Dr. Calvert for having brought this subject before them; also to Mr. Wentworth Scott for his practical remarks. He hoped that gentleman would be led to prosecute his researches further. He had gone to the extent of obtaining what chemists call dianthine, and had got results which led him to believe that he had obtained crystals of alizarine. If it could be got at all it could be procured in any quantity when once they knew how to go about it. The remarks of Mr. Wallis held out the hope that he might be induced to give the society the benefit of his large experience in connection with this subject, and to bring before them a history of American machinery as applied to this branch of industry in a more attractive form than was to be found in the parliamentary blue books. He hoped the suggestion of one of the members of the council would not be lost sight of, but that they might have an opportunity of having further details of the practical methods in which these various substances had been applied. He begged to propose a vote of thanks to Dr. Calvert for his very able and interesting paper.

The vote of thanks having been passed,

Dr. Crace Calvert expressed his readiness to give another paper on this subject at any time the Council might think most advisable. He had no doubt the illustrations of the substances used in calico printing, promised by Mr. Rumney for the International Exhibition, would be extremely valuable; but it was easy to understand that in order fully to appreciate the value of such illustrations, it was necessary that some one should give to the members of this Society some explanations which would enable them to see the application of these discoveries. Thus, if a person saw a piece of print of any particular colour, it was desirable that he should know how that result was obtained, and then when Mr. Rumney's collection was placed before him he would at once see the bearings of the various improvements and the important results which must flow from them. The object of papers read before this Society was to diffuse knowledge which might lead to further discoveries. The great thing was not to stop where they were, but to make their present knowledge the key to further progress. And how was this to be effected, if they were not perfectly acquainted with what had been done up to the present time. He wished those who were interested in this question to look over the specimens of prints which would remain in the room a day or two, and by reading the labels attached to each, they would be better able to understand what was explained in the paper, and in that way the reading of the paper would become practically interesting and useful. There was one point he would refer to which arose out of the remarks of Mr. Willis, that was the extraordinary improvements that had taken place in the art of engraving. Those pieces of furniture styles, which, to a casual observer appeared to have nothing very remarkable about them, were, nevertheless, extraordinary productions. A few years ago they would have cost twelve or fourteen shillings a piece, because they were done by hand-labour and block-printing, but now, by the aid of machinery and the art of engraving, and by the introduction of the large copper rollers referred to in the paper, these results were obtained at a much cheaper rate. Such goods were now printed by hundreds of thousands of yards for the markets of Persia, Egypt, and India, by our Manchester manufacturers. He was happy to find that the gold medal at the Paris Exhibition of 1855 was gained by a Manchester manufacturer for this class of goods, and he hoped the same honour would be conferred upon an English manufacturer in the Exhibition of the present year. Referring to Mr. Wallis's observations on the importance of the improvements in machinery which had taken place in the last ten years, Dr. Calvert remarked that owing to these improvements, not only were goods produced at a cheaper rate, but the machinery employed for finishing goods furnished remarkable instances of mechanical skill applied to calico printing. He directed attention to the superior style and variety of finish observable in the goods of the present day, and this he said was entirely due to the improvements in machinery; therefore, any gentleman who brought before the Society details of progress in that direction would render great service to the public at large.

The Paper was illustrated by a large collection of chemical substances and printed fabrics referred to in the Paper furnished by Dr. Crace Calvert, and also by a collection of printed fabrics lent by Mr. A. Salamons.

The Secretary announced that on Wednesday evening next, the 12th inst., a Paper by Mr. Edward C. C. Stanford, F.C.S., "On the Economic Applications of Sea-weed," would be read.

Home Correspondence.

VENTILATION OF MINES.

Sir,—I beg to call the attention of those of your readers who may be connected with our collieries, to my letter on this subject inserted in your *Journal* of the 8th of March last, page 262. The two principal points maintained in that communication are:—

First.—The absolute necessity of having at least two separate shafts, one for the ordinary working of the mine, and the other for ventilation, but both equally accessible to the miners from below.

Secondly.—That the ventilating machinery, of whatever kind, shall be entirely above ground.

The contravention of both these rules has just caused two most lamentable disasters, involving in the case of the New Hartley works, not only the destruction of two hundred human beings and the consequent destitution of four hundred widows, children, and others, but also the probable ruin, eventually, of the proprietors of the colliery. In both cases the furnaces were underground, and when the ventilation was arrested, of course the whole of the works became deadly with carbonic acid gas and carbonic oxide, besides the usual impurities always exhaled in the workings. The sole cause of placing the furnace underground, is the desire to avoid the expense of building a tall smoke chimney over the upcast above ground, which alone would, in many cases, be sufficient to effect the intended purpose, but which always renders any kind of ventilating apparatus both simple and inexpensive.

At the New Hartley works the managers were not content with the inevitable accidents inseparable from all underground works, but they must superinduce all those that by any possibility can be caused, by having one shaft only for all purposes; and, in addition, a projecting half of an enormous engine-beam right over the pit, well-knowing that cast-iron is nearly as fragile as glass, and always breaks without giving the slightest warning. Large castings are, moreover, notoriously unsound, as they cannot be cast with sufficient head to compress the metal while setting; and even wrought-iron will break, in hundreds of instances, quite short, without notice, presenting a fracture not very dissimilar from that of cast metal.

The fatal mistake, however, was that of allowing any material or piece of machinery whatever to be placed over the shaft, the same not being indespensably necessary for lifting and lowering the daily shifts of the miners, overmen, and viewers, almost hourly passing up and down the shaft.

There is no true economy in such inefficient half-measures, because the produce of the mines will be greater, and far more profitable to the owners, when the miners shall only have their proper difficulties to contend with, and shall be enabled, by improved measures, to carry on their work with plenty of light and fresh air; besides, it is impossible to put human life, or even that of horses, in competition with sordid economy.

The fact is, that associations of men, such as railway directors, coal-owners, ship-owners, and others, however individually they may be, and are, gifted with the virtue of humanity, they are—as a body— as hard and stubborn as granite. Ship-owners, indeed, publicly declare that it is no part of their business to provide any measures for the safety of human life from disasters at sea, excepting only so far as they may be compelled to do so by sundry Acts of Parliament.

These malpractices will never be repressed or amended without legislative interference, but as it would be unwise to be continually adding enactments to enactments, already too numerous by thousands, a better mode would be—to render the present laws more effective by enabling juries to find a verdict of "Manslaughter" against the owner, director, manager, or whosoever may have supreme control of the works, for each individual case of death or mutilation caused by preventable accidents.

My attention has been more immediately directed to this subject by a notice in your last *Journal*, page 164, of M. Mozard's "Improvement in the Miner's Safety-Lamp," which I have already stated, in my former communications, ought only to be used as an indicator of danger, and not as a working light, because in itself it is liable to a thousand accidents, and at best only furnishes the miner with a miserable light, and enables him to work in an atmosphere highly detrimental to the human frame.

I am, &c.

HENRY W. REVELEY.

February 3, 1862.

Proceedings of Institutions.

LOCKWOOD MECHANICS' INSTITUTION. — The annual general meeting of the members of this Institution was held on Wednesday evening, 29th January, 1862, Mr. G. SHAW in the chair. The secretary read the report, from which it appeared that there are at present 141 male and 44 female members. There are 11 classes for males, taught by eight paid teachers and three voluntary teachers. There are also four classes for females, taught by two paid and two voluntary teachers. The receipts from all sources had been £106 2s. 10½d., and the disbursements £106 19s. 11½d. Altogether the Institution is not in so favourable a position as it was the previous year, but the report attributes this to commercial depression and other untoward events during the past year. The following gentlemen were elected to serve on the committee for the present year:—Bentley Shaw, Esq. J.P. (President); Mr. Spencer Beaumont (Treasurer); Rev. J. B. Bensted, M.A.; Rev. John Barker; Messrs. Charles Kaye, Samuel Ogden, James Brierley, Samuel Lodge, John Dow, Alfred Crowther, Thomas Haigh, Nathaniel Berry, Timothy Tate, Samuel Black, William Whiteley, James Kenworthy, F. W. Armitage, J. W. Spedding, Henry Taylor, and Benjamin Armitage, jun. The Rev. JOHN BARKER and Mr. NATHANIEL BERRY each addressed the members present, urging upon them the necessity of closer application to, and more perseverance in, the several branches of knowledge taught in the classes of the Institution.

MEETINGS FOR THE ENSUING WEEK.

MON......Roy. Geographical, 8½. 1. Dispatch from His Excellency Sir Henry Barclay, Governor of Victoria, "On the Expedition, which, under the late Mr. R. O'Hara Burke and Mr. W. J. Wills, with Messrs. Grey and King, succeeded in crossing the Australian Continent, from Melbourne to the Gulf of Carpentaria."—Communicated by His Grace the Duke of Newcastle; and 2. "Journals of the Expedition, with the Astronomical Observations of Mr. Wills."—Communicated by Governor Barclay to Sir Roderick I. Murchison. 3. "Proceedings of the Exploring Party, under Mr. F. T. Gregory, in North-West Australia." 4. Letter from Capt. Cadell to Sir Roderick I. Murchison, "On the Country to the East and North of the Grey and Stanley Ranges."
Medical, 8½. Mr. Henry Thompson, F.R.C.S. Lettsomian Lectures.—1. "Lithotomy—The several methods which are adopted at the present day for the male subject."

TUES. ...Medical and Chirurgical, 8½.
Civil Engineers, 8. Continued discussion upon Mr. Samuda's paper "On Iron-Plated Ships," &c.
Zoological, 9.
Syro-Egyptian, 7½. 1. Rev. Mr. Cowper, "On Ancient Syrian Philosophy, from a Syriac MS." 2. Mr. Joseph Bonomi, "On the Camel, and its relation to Egypt."
Royal Inst., 3. Mr. John Marshall, "On the Physiology of the Senses."

WED. ...Society of Arts, 8. Mr. Edward C. Stanford, F.C.S., "On the Economic Applications of Seaweed."
Graphic, 8.
Microscopical, 8. Annual Meeting.
Literary Fund, 3.
Royal Soc. Literature, 8½.
Archæological Association, 8½.

THURS...Royal, 8½.
Antiquaries, 8½.
Philological, 8.
Royal Soc. Club, 6.
Royal Inst., 3. Professor Tyndall, "On Heat."

FRI.......Astronomical, 3. Annual Meeting.
Royal Inst., 8. Dr. Odling, "On Mr. Graham's Researches in Dialysis."

SAT.......Roy. Asiatic, 3.
Royal Inst., 3. Rev. A. J. D'Orsey, "On the English Language."

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, January* 31*st*, 1862.]

Dated 19*th September*, 1861.

2341. W. T. Tongue and J. Greer, Liverpool—An improved portable self-acting water-engine for extinguishing fires and other purposes.

2342. J. H. Wilson, Liverpool—Imp. in pumps chiefly applicable to ships' lift pumps.

Dated 27*th September*, 1861.

2415. G. Smith, Liverpool—Imp. applicable to gas meters.

Dated 9*th October*, 1861.

2520. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. in machinery for manufacturing shoes for horses and other animals. (A com.)

Dated 21*st October*, 1861.

2626. Major J. S. Phillips, 10, College-crescent, Finchley-road—A new method and apparatus for the propulsion of vessels through the water.

Dated 25*th October*, 1861.

2677. T. Richardson, Newcastle-on-Tyne, and R. Irvine, Hurlet, Renfrewshire—Imp. in treating bones and gelatine.

Dated 4*th November*, 1861.

2769. W. Clark, 53, Chancery-lane—Imp. in water meters. (A com.)

Dated 15*th November*, 1861.

2855. W. H. Balmain and J. Kean, St. Helen's, Lancashire—Imp. in the manufacture of flowers of sulphur and roll and other forms of sulphur.

Dated 26*th November*, 1861.

2974. D. Ker, Plymouth—An imp. in the manufacture of soap.

Dated 16*th December*, 1861.

3156. J. Aitken, Lasswade, near Edinburgh—Imp. in supplying water to water wheels.

3158. C. Baumann, Altdorf, Weingarten, Wurtemberg—Imp. in buttons.

Dated 19*th December*, 1861.

3185. A. Treuille and F. X. Traxler, 53, Chancery-lane—Imp. in the manufacture of paper and card paper or cardboard, with the object of preventing forgery and alterations in cheques and other documents, and which imps. are also applicable to the manufacture of playing cards and railway and other tickets. (A com.)

Dated 20th December, 1861.

3196. W. Clark, 53, Chancery-lane—Imp. in apparatus for the manufacture of matches. (A com.)

3199. E. E. Pereau, Moorgate-street—An improved composition for cleaning and revivifying woollen cloths and other fabrics, and the colors thereof. (A com.)

Dated 21st December, 1861.

3210. W. C. Miles, Railway-place, Shoreditch—Imp. in lamp glasses for lamps burning paraffine and other light mineral oils.

Dated 24th December, 1861.

3216. C. Smith, Bedford—Imp. in stays.

3218. C. Smith, Bedford—Imp. in stays.

Dated 26th December, 1861.

3228. T. Simmons and T. Timmins, Birmingham—Certain imp. in urns or vessels for holding and supplying hot water, tea, coffee, or other liquids separately or conjointly, as also in the stands for the same.

Dated 27th December, 1861.

3240. W. Turner and J. W. Gibson, Hammersmith, Dublin—Imp. in rolling bridges.

Dated 30th December, 1861.

3258. J. B. Payne, Chard, Somersetshire—Improved machinery for the manufacture of laid and other twine, lines, ropes, bands, and other cordage, whether made of hemp, flax, or other fibrous substances, or of wire.

Dated 1st January, 1862.

8. R. A. Brooman, 166, Fleet-street—Imp. in shears or scissors, chiefly applicable to be employed in the manufacture of laces. (A com.)

11. B. Rhodes, Old Ford, Bow—Imp. in forming or making straight and bent pipes and bends for pipes, and also vessels of various shapes, and in coating and protecting objects and articles of various forms, and in the apparatus to be employed therein.

12. E. Banfield, Ilfracombe, Devonshire—Imp. in lubricating and maintaining in working order axle journals and brasses applicable also to other journals and bearings.

15. J. Howard and E. T. Bousfield, Bedford—Improved apparatus applicable to steam cultivation.

Dated 2nd January, 1862.

19. A. M. P. Airiau, Paris, Rue St. Dominique, St. Germain, No. 8—A new musical instrument.

22. G. Jeffries, Golden Ball-street, Norwich—Imp. in breech-loading fire-arms.

Dated 3rd January, 1862.

25. G. Stracey, Rackheath-hall, near Norwich—Imp. in the manufaeture of artificial fuel.

27. W. E. Gedge, 11, Wellington-street, Strand—Imp. in apparatus for dressing, cleaning, or sifting grain.

Dated 7th January, 1862.

44. F. Shaw, Sheffield—Imp. in apparatus for stopping railway trains.

Dated 9th January, 1862.

61. J. Brunt, 15, Rue Petrelle, Paris—Imp. in gas meters.

63. D. Wilson, Colombo, Ceylon—Imp. in machinery for pulping and preparing coffee.

65. D. Wilson, Colombo, Ceylon—Imp. in hydraulic presses.

67. R. A. Brooman, 166, Fleet-street—Imp. in apparatus for carburetting and burning gas. (A com.)

69. H. Barber, Belgrave, Leicestershire—Imp. in safety lamps.

Dated 10th January, 1862.

70. A. R. Le Mire de Normandy, Odin-lodge, King's-road, Clapham-park—An improved method of fixing tubes in tube plates.

71. J. Carter, Tipton, Staffordshire—A new or improved draining plough.

73. M. Wigzell, The Strand, Topsham—An improved double acting ventilator for railway carriages and other carriages and compartments.

75. J. Oates, Mirfield, Yorkshire—Imp. in washing machines.

76. H. Darvill, New Windsor—An improved method of hardening chalk for building purpeses.

77. W. H. Preece, Southampton—Improved apparatus for signalling upon railways.

79. J. Kenyon, Ivy-cottage, Lower Heath, Hampstead, and A. Horn, Great James-street, Bedford-row—Imp. in railway signalling by electricity, and in the arrangement of apparatus for that purpose.

January 11th, 1862.

83. J. White, 7, Trinity-street, Southwark—Imp. in lubricating, or oil cans, or oil feeders, and in the mechanical arrangements for regulating the flow of oil therefrom.

84. L. Mackvidy, Greenock—Imps. in apparatuses for reburning animal charcoal.

85. T. Scott, Nelson-square—Imp. in steam engines.

Dated 13th January, 1862.

88. J. M. Rowan, Glasgow—Imp. in the manufacture of iron and steel.

89. T. Gilbert, Birmingham, C. Gilbert, and T. Haddon—An imp. or imps. in the manufacture of swivels for guns, and in machinery to be employed in the said manufacture.

91. T. Soar, Nottingham, J. Belshaw, Radford, and M. Soar, Nottingham—An improved knocker to be attached to doors, shutters, or other parts of premises to which the same may be applicable and applicable also for the reception of letters and other documents.

95. H. Schottlander, Paris—Imp. in albums for containing photographic and other pictures.

97. J. Betteley, Liverpool—Imp. in ship building.

98. T. W. G. Treeby, 1, Westbourne-terrace Villas, Paddington—An improved method of, and apparatus for, producing rifled cannon and fire-arms.

99. J. G. Marshall, Leeds—Imp. in the preparation of flax, hemp, and other fibres previous to being spun.

Dated 14th January, 1862.

101. J. Carter, 20, Danvers-street, Paulson-square, Chelsea—An improved shaft tug or bearer used in harness.

104. J. Jack, Liverpool—An improved method of preparing cores for moulding or shaping metals.

105. M. Chadwick, Radcliffe—Imp. in machinery for folding or platting cloth and for measuring the same.

109. C. Hill, Ferryside, Kidwelly, Carmarthen—Imp. in the manufacture of lubricating compounds.

111. J. G. Marshall, Leeds—Imp. in the machinery and processes for producing fibre from woven and other textile fabrics.

Dated 16th January, 1862.

120. T. Matanle, 5, Wilmot-square, Bethnal-green-road—An improved runner fastening for umbrellas, parasols, sunshades, and other similar articles.

Dated 18th January, 1862.

130. J. Tow, Poland-street, Oxford-street—Imp. in the construction of stoves or fire places.

132. T. Newton, Manchester—Imps. in sights for rifles.

138. W. L. Winans, Brighton—Imp. in the manner of mounting and apparatus for manœuvring cannon or ordnance on ships or vessels of war and floating batteries.

Inventions with Complete Specifications Filed.

196. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the prevention or removal of incrustation in, or from, steam generators, and in the apparatus employed therein. (A com.)—25th January, 1862.

218. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Imp. in engines actuated by heated air, or by combinations of air and steam. (A com.)—28th January, 1862.

Patents Sealed.

[*From Gazette, January 31st*, 1862.]

January 31st.

1928. C. Schinz.
1934. A. Prince.
1943. R. A. Brooman.
1944. F. Seiler.
1950. R. Wappenstein.
1952. F. Tolhausen.
1953. J. Mac Morran.
1957. A. V. Newton.
1966. T. G. Webb.
2026. W. Wilds.
2053. W. Bennett.
2063. G. Ingram.
2088. M. A. F. Mennons.
2109. W. D. Player.
2222. M. A. F. Mennons.
2230. J. J. Russell.
2268. M. A. F. Mennons.
2295. A. C. Jennings.
2524. J. J. Russell.
2575. J. J. Adams.
2686. J. L. Sicard.
2810. A. B. Berard.
2863. G. T. Bousfield.

[*From Gazette, February 4th*, 1862.]

February 4th.

1959. F. Silveston.
1981. A. J. Mott.
1982. C. P. Moody.
1986. H. Chatwin.
1989. J. Gray, T. Kershaw, B. Crowther, and A. Dean.
1990. R. A. Godwin.
1997. A. Barclay.
1998. M. Wigzell.
1999. M. Wigzell.
2015. B. Cooper.
2017. E. A. Rippingille.
2029. S. Carey and W. M. Pierce.
2065. W. Fitkin.
2074. R. S. Lambert.
2078. N. Fisher.
2083. W. Clark.
2094. J. Kane.
2102. W. Baines.
2104. J. Whitworth and W. W. Hulse.
2117. J. Cranston.
2143. W. S. Guinness.
2676. J. B. Schalkenbach.
2738. W. J. Williams.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, January 31st*, 1862.]

January 27th.

280. J. Grimond.

January 28th.

576. J. Robertson.
422. J. T. Jones.

January 29th.

301. S. Tearne.
304. J. Hirst, jun., and J. Hollingworth.

[*From Gazette, February 4th*, 1862.]

January 30th.

295. W. E. Newton.

January 31st.

312. S. D. Davison.
357. A. Clark.
398. S. H. Huntley.

February 1st.

309. W. Clayton and J. Goodfellow.
326. P. Adie.

Patents on which the Stamp Duty of £100 has been Paid.

[*From Gazette, January 31st*, 1862.]

January 27th.

250. G. Ritchie.

January 22th.

320. A. E. L. Bellford.

[*From Gazette, February 4th*, 1862.]

February 1st.

244. T. O. Dixon.